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JUNE-JULY 1954

VOLUME 47 NUMBER 6

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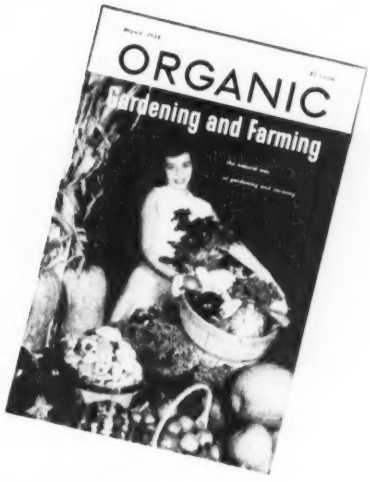

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Nature in Print

By HOWARD ZAHNISER

FOR the equivalent of a monthly payment on an automobile it is possible to possess one of the most magnificent and exquisite material evidences of our esthetic and scientific appreciation of the American outdoors that has yet been manufactured. In the wealth of two majestic volumes produced with superb graphic and typographic skill there live the watercolors of an inspired artist, giving beauty and vitality to the great body of knowledge developed by a devoted botanist through half a century. This work is *Wild Flowers of Western Pennsylvania and the Upper Ohio Basin*, published for the University of Pittsburgh, the Carnegie Institute and The Buhl Foundation by the University of Pittsburgh Press—and offered for sale "at far less than the costs of print, illustration, and binding."

The publication is indeed an event. These volumes have been chosen as among America's "Fifty Best Books" of 1953, and in the field of "Nature in Print" they are in all likelihood well near the top among the fifty best books in many a year. Its editor, Agnes Lynch Starrett, refers to it—reasonably, we surmise—as "a book that in beauty, in scientific integrity, and in design takes its place among the finest illustrated botanies of ten centuries." In a publishing season that has flourished with wildflowers—witness *The Macmillan Flower Book* and Crown Publishers' lithographic reproduction of Mary Vaux Walcott's watercolor prints in the new book *Wild Flowers of America*—each of which has already been reviewed in this magazine by the editor—this western Pennsylvania botany and collection of watercolors is the climax. Happy are those who live in its region and can combine the richness of its possession and contemplation with practical usefulness in field study, but fortunate are all who can see and enjoy these volumes anywhere—in public libraries, for example.

The very data regarding these volumes are interesting and fascinating to any who love flowers or beautiful books. The publisher tells us that eight years were spent in studying the ways and means of publication, with the purpose of finding "just the right materials and the right craftsmen." In 1949 The Buhl Foundation made the necessary funds available to the University of Pittsburgh and the Carnegie Institute, and under the sponsorship of these three Pittsburgh institutions the editing and processing of the publication began by the University of Pittsburgh Press.

Paper high in rag content—70-pound paper for the volume of text, 90-pound paper for the illustrations—was made especially for this work "to give just the right durability and opacity for type and watercolor," with a color tone appropriate to a watercolor technique that uses the white of the paper as part of the picture. Separate sheets are used in the illustration volume for the legends and comments on the paintings, and these are "bond legend sheets . . . 100 percent rag especially blended to the text sheet and to the watercolors."

The book pages are 10-¾ inches wide and 14 inches high, "to allow that the plants be life-size and to permit generous margins and pleasant spacing." The binding has an assurance of strength and attractiveness—"washable, durable, green linen" printed on in gold, and even the dust jackets are elegant, made of "Elephant Hide paper," we are told, golden tan, and printed with green ink.

It is indeed a pleasure to contemplate the type and its handsome arrangement on cover, binding, and especially on the books' generous-sized pages. The title pages and dust jacket were designed by Theodore Bowman of the University of Pittsburgh architectural services, with a hand-lettering that harmonizes with the text typography. The type face used in this text is Monotype Janson, selected "as particularly suitable for a scientific work illustrated with lovely water colors, because it combines with compactness and legibility, delightful irregularities, crisp serifs, and a vibrant italic." The ink used in printing the legends in the illustration volume "is a special gray-green to blend with the water colors."

With such exquisiteness in typography to please one, it is surely a delight extreme to appreciate the craftsmanship in reproducing the watercolors—with a three-color, sheet-fed gravure, using the same three primary colors with which the originals were painted.

But this is to exclaim over the appearance of the books, as well we may, although surely this ought to be in an approach to the work itself—a remarkable collaboration of two eminent scholars (whose lives, "Vitae," are included in the introductory pages of Volume II).

In 1904, when Otto E. Jennings assumed charge of the Carnegie Museum's botanical collection, he found it "clearly apparent" that this western Pennsylvania, upper Ohio region was "for the most part unexplored botanically." This publication—particularly its Volume I—represents Dr. Jennings's life work in half a century of intensive study in field and herbarium and in companionship with Grace E. Kinzer, who also began her botany at the Carnegie Museum in the early years of the century and who soon (on June 30, 1906,) became Mrs. O. E. Jennings. The volume contains, as summarized by its editor, "accurate information for about 2200 species, including family and genera, ecology, national and international distribution keys, and descriptions which help identify the plants. . . . About 75 introductory pages cover soils, climate, physiographic and typographic history, geology, plant geography, the historic development of botany in the region, a glossary, a gazetteer, a list of collectors and authorities, a systematic list of plant families, a key, and a bibliography." This introduction has a rainfall map, a growing season map, and the text is illustrated with 146 range and distribution maps. An index not only covers in thorough fashion Volume I, but also includes references to the plates in Volume II.

Through Volume II also runs our delight in the achievement of Dr. Jennings and his companion, but here it is heightened and brightened with the paintings of a fellow scholar who verily is among the Twentieth Century's colorful and eminent men of science and art—Andrey Avinoff. Born in Tulchin, Russia, the son of a general, in 1884, emigrant to the United States in 1917, he was a specialist in entomology (owner of a most noted collection of Asian butterflies) and an artist, who started exhibiting paintings in 1904, but also a notable museum administrator. From 1926 to 1945 he was the Carnegie Museum's director, and from then until his death in 1949 its director emeritus. From him came the 200 watercolors illustrating 253 kinds of flowers that make Volume II of this work brilliant and vital—life-size paintings from living plants in a "thoroughbred aquarelle" technique that uses only the three primary colors, no black, and, similarly printed with the three-color gravure, has the highlights provided entirely by the white of the paper. The results are indeed breathtaking.

Agnes Lynch Starrett tells most engagingly, in her introduction to this Volume II, of the collaboration that has given us these watercolors. We can only quote it—with a reflection, however, on the reassurance it is, a decade later, to know of these

Tawny Daylilies

By MAY ALLREAD BAKER

These lilies lift their glowing cups
In clusters tall and dense
Where buildings crumble to decay,
Or by the roadside fence.
While in old gardens long untilled
By either spade or plow,
These tawny, lemon-throated flowers
Bloom in profusion now.
And ancient graveyards welcome them,
Where folk forgotten lie.
They make a blaze of color there
These days in hot July.

activities in those war years when this work was done. As we read in Dr. Jennings's informal informative comments that face these watercolors the dates when the specimens represented were collected, we can think again and again of the world stress in which these flowers grew and were gathered and in which their beauty was recreated in these artists' colors now here reproduced. Mrs. Starrett writes:

"Dr. Jennings began to collect plants which Dr. Avinoff was to paint in the spring of 1941 and continued to bring them in to Dr. Avinoff through the flowering seasons of 1941 and 1942. Dr. Jennings selected first, plants from species most characteristic of the region; second, plants from species rare in the region; and third, plants from species showing particularly interesting botanical characteristics. For the most part he excluded the wild flowers which had been commonly illustrated in color by other artists.

"Often it was hard for Dr. Jennings to decide when and where to go to find in prime of bloom the plants he wanted. He made many long trips in vain. Mrs. Jennings was his chauffeur, so that he could be free to search for the perfect plant. During the flowering seasons of the two years they searched nearly every part of the western half of Pennsylvania—more than six thousand miles of travel. He and Mrs. Jennings devised many ingenious ways of keeping the specimens fresh for the artist.

"Dr. Avinoff, realizing the responsibility Dr. Jennings had taken for gathering just the right specimen and getting it to him while it was fresh, worked quickly so that what he painted might be true and accurate and alive. Often, when the plant was brought in he dropped everything else and worked far into the night to make sure that the flowers would not have time to wither or droop before he finished painting them. Some of the paintings took seven hours to finish. There was the orchid which can be found only in Crawford County near the Ohio line. After considerable correspondence with the farmer on whose land the orchid was growing a collection date was set. When, late on Saturday night, Dr. and Mrs. Jennings got home from their expedition, the telephone rang. Nothing would do but that Dr. Avinoff should have the plant at once. The orchid was delivered at once, and Dr. Avinoff stayed up all night to finish his water-color. Dr. Avinoff estimated that it took him about 1600 hours to paint them all.

" 'These,' he said, 'were my guiding principles: (1) accuracy in form and color; (2) portrayal of the individuality of the plant as to the character, position, arrangement, and venation of the leaves and the texture of their surfaces; (3) decorative arrangement, composition, and spacing; (4) strictly water color technique—only transparent pigment and no opaque colors, no white paint anywhere, not a single stroke used in the high lights. The white is the paper and all light parts are lighter washes of the pigment. Thoroughbred aquarelle has been observed throughout.'

"And at last, in 1942, Dr. Avinoff had completed 296 water colors illustrating 351 native or naturalized wild flowers, most of which had not heretofore been illustrated in color. The 200 water colors finally selected for this volume show 252 plants; 41 of the plates show more than one plant."

Here, then, are these volumes, thus merely introduced, the essence of their enjoyment only suggested. The temptation is strong to linger over the flower plates, one by one, teased with a challenge to find words to fit the appreciation. Reminiscence of past delight with the flowers themselves, anticipation of actually seeing them in the future—both join in intensifying the intrinsic delight in beholding the paintings. And this delight is not only supplemented but enriched by the text comments that face the plates, and by the great apparatus of botany that comes to us in the companion volume. Here, then, are these volumes! As Edmund Ware Sinnott says in his preface: "They deserve a royal welcome."

Wild Flowers of Western Pennsylvania and the Upper Ohio Basin. Text by O. E. Jennings. Watercolors by Andrey Avinoff. Pittsburgh, Pennsylvania: University of Pittsburgh Press. 1953. Two Volumes (10-$\frac{1}{2}$ by 14-$\frac{1}{4}$ in.).

Volume One: lxxv + 574 pp., with preface by Edmund Ware Sinnott, editor's foreword by Agnes Lynch Starrett, 150 text maps (4 maps showing the region, soil series, precipitation, and length of growing season and 146 distribution maps), bibliography, gazetteer, glossary, analytical key to families, history of botany in the region, descriptions of 2801 different kinds of plants, and index.

Volume Two: xvi pp., with preface by Fiske Kimball, biographies of Andrey Avinoff and Otto Emery Jennings, introduction by Agnes L. Starrett, 200 color plates by Andrey Avinoff and descriptions on separate, facing sheets by O. E. Jennings.

Two Volumes (limited edition only, of 3000 sets) $60.

Parrots

Parrots and Parrot-like Birds. By the Duke of Bedford, with a section on Diseases of Parrots by David L. Coffin. Fond du Lac, Wis. 1954. All-Pets Books, Inc. 210 pages. Illustrated. $6.00.

Those who are interested in owning and caring for psittacine birds will find a great deal of practical information and advice in this book. The late Duke of Bedford was a noted British aviculturist. Shortly before his tragic death he had brought up to date his book on parrots and their kin, and the result is here made available.

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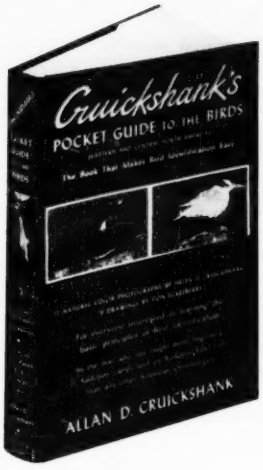

Cruickshank's Pocket Guide To the Birds

(Eastern and Central North America)

For many years, all over the country, Allan Cruickshank has been teaching bird identification. He has led more Audubon bird walks, delivered more Audubon lectures, officiated at more Audubon camps than any other ornithologist in the country. Now, for the first time, he sets down in writing and pictures the fruit of all this experience.

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There are a number of noteworthy features about this book. First is the magnificent collection of seventy-two natural full-color photographs by Helen Cruichshank which are startlingly beautiful in themselves and most valuable for identification.

Don Eckelberry, to supplement the text, has drawn a representative bird for each of the seventy-eight family groups. These fine drawings have also been reproduced in habitat groups to relative scale for quick field recognition in a "Visual Key" of eight pages, which is an original feature of this book.

There is also much valuable material on bird songs, on bird mannerisms, on distinguishing birds which look alike. Anyone knows a robin from a crow; Cruickshank has ingenious ways of his own of showing you how to tell a vireo from a warbler, a gull from a tern.

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Summer Courses

It seems to be typical of those planning summer Nature workshops and conservation education courses that they often get around to making announcements too late for them to be effectively publicized in monthly publications, which necessarily work in advance. Since our May issue went to press information about several summer courses has come to hand, and we list them for those who may not already have made plans.

At Versailles State Park, Indiana, the ninth annual Conservation Education Camp, sponsored by the Indiana State Department of Public Instruction, the Indiana Department of Conservation and Purdue University, will hold sessions from June 21 to July 10 and from July 12 to July 30. Full details from Howard H. Michaud, Department of Forestry and Conservation, Purdue University, Lafayette, Indiana.

The New Jersey State School of Conservation will hold summer sessions at Stokes State Forest, Branchville, N. J., with courses starting June 3 and ending September 6. Details from Edward J. Ambry, New Jersey State School of Conservation, Upper Montclair, N. J.

From Dr. L. B. Sharp, Outdoor Education Association, 369 Lexington Ave., New York 17, N. Y., comes announcement of the fifteenth season of summer courses for advanced leadership preparation in camping and outdoor Education. Sessions are held in the Poconos at Matamoras, Pa.

Trail Trips

Fifteen western trail trips into wilderness and primitive areas of eleven States are being offered this year by the American Forestry Association, 919 17th Street, N. W., Washington 6, D. C. The Association will start its third decade of conducting these trips, on which have gone more than 2600 men and women. Full details are available on request.

Maple Growers

Aroused by their studies that revealed the importance of birds in controlling insects in an agricultural area, the biology class of St. Michael's School in Maple Grove Township, Saginaw County, Michigan, decided something should be done. They formed the Maple Grove Bird Club and then signed up the entire school body to support its platform. Their goal is protection of song and insectivorous birds, plantings to attract birds, erection of proper bird houses, winter feeding and the study of practical ornithology. Already they have conducted a survey of the birds in the township, listed those species specially to be attracted and each student has built a bird house. Purple martins are being specially wooed.

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Scout Conservation

Dedicating themselves to doing a Conservation Good Turn in 1954, the Boy Scouts of America have adopted an Outdoor Code. The Scouts pledge themselves as follows:

"As an American, I will do my best to:

BE CLEAN IN MY OUTDOOR MANNERS

I will treat the outdoors as a heritage to be improved for our greater enjoyment. I will keep my trash and garbage out of America's waters, fields, woods, and roadways.

BE CAREFUL WITH FIRE

I will prevent wild fire. I will build my fire in a safe place, and be sure it is out before I leave.

BE CONSIDERATE IN THE OUTDOORS

I will treat public and private property with respect. I will remember that use of the outdoors is a privilege I can lose by abuse.

BE CONSERVATION-MINDED

I will learn how to practice good conservation of soil, waters, forests, minerals, grasslands, and wildlife; and I will urge others to do the same. I will use sportsmanlike methods in all my outdoor activities."

Mettler's Woods

Time is running out in which it will be possible to save Mettler's Woods, a 136-acre tract of virgin oak, cherry and hickory. Thomas Mettler, a descendant of the family that has held this New Jersey tract since 1690, has extended to July 1, 1954, the date by which the Committee for the Preservation of Mettler's Woods must raise funds to prevent sale of this invaluable virgin stand for lumbering. The committee needs $75,000 to purchase the land, which will, if acquired, be deeded to Rutgers University for permanent preservation. William H. Cole, Rutgers University, New Brunswick, N. J., is secretary of the committee.

Pine Seedlings

Thirty million pine tree seedlings were distributed during the 1953-54 planting season by the International Paper Company's Southern Kraft Division. This program has resulted in 42,000 new acres being put into tree production during the year. Distribution was to landowners, 4-H Club members, schools and otherwise.

For Wildlife Refuges

From the Citizens Natural Resources Association of Wisconsin come some sheets of stamps. They picture flying Canada geese, painted by Owen J. Gromme, and bear the slogan; "Keep Our Wildlife Refuges Inviolate." In sending out these stamps the Association includes the following message:

"Migratory Bird Refuges are the foundation of our waterfowl perpetuation program. They are the major reason that we still have ducks and geese to hunt. In the interests of hunters, of bird-watchers, and of the general public, these Wildlife Refuges must be kept inviolate. Shooting areas can be provided outside of Wildlife Refuges. Public conservation agencies can acquire or lease shooting areas outside, and must be prevented from pushing shooting inside. This is the problem and there is much work to do. This is no time to contract, and to diminish, the lands needed by our waterfowl, simply because of increased hunting demand. The hunting problem can be solved without jeopardizing ducks and geese only if the basic core of inviolate refuges is maintained; only by expanding the hunting areas without encroaching upon the lands we all set aside to perpetuate waterfowl. A short-sighted policy of immediate use, and of inviolate refuge invasion, cannot be justified as 'conservation,' or as 'wise use' of wildlife. Let's not go backward in conservation! Keep Our Wildlife Refuges Inviolate."

Funds derived from the sale of these stamps will be used to support the active conservation work of CNRA. Seven sheets of stamps, totalling 28 stamps, are sold for $1.00; single sheets of four stamps for 15 cents. Stamps may be ordered from H. D. Roberts, 610 Harrison St., Black River Falls, Wisconsin.

Study F. & W. Service

A five-man committee has been appointed by the Secretary of the Interior to make a survey of the organization and operating procedures of the U. S. Fish and Wildlife Service. The committee, which began work in mid-April, consists of James Turnbull of the Monsanto Chemical Company's western headquarters; Ross Leffler, chairman of the Pennsylvania Game Commission; John D. Pennekamp, associate editor of the *Miami Herald*; John D. Bennett, assistant director of the Interior Department's Technical Review Staff; M. George Goodrick, Division of Management Research.

Dr. Bryant Retires

Veteran of the National Park Service, Dr. Harold C. Bryant, who first organized a Nature education program in Yosemite National Park in 1920, has retired. He had been serving since 1941 as superintendent of Grand Canyon National Park. He will be succeeded by Preston P. Patraw.

Forest Cover Types

A new bulletin describing the forest cover types of North America has been published by the Society of American Foresters, 425 Mills Bldg., Washington 6, D. C. It contains detailed descriptions of the forest types of the United States, Canada and Alaska. Copies are available for one dollar.

Contents Noted

DURING 1953, records show, some 35,400,000 people visited our National Forests for recreational purposes. They used these areas for picnicking, fishing, hunting, camping, winter sports, swimming, hiking, riding, canoeing, wilderness travel and just plain enjoyment of the outdoors. And these do not include the estimated ninety million people who drove over forest highways to enjoy forest scenery. This 1953 figure is an increase of seven percent above the 1952 number, and use of the National Forests for recreation has increased 97 percent since 1941. Nothing could more graphically illustrate the need for the passage of the Baker Bill, H.R.1972, which would allocate a percentage of the receipts from National Forests—up to a maximum of $5,500,000 annually—to aid the Forest Service to meet the needs of the recreationists. It is a fact that the Forest Service is faced with inadequate funds and facilities to meet this pressure of public use. Sanitary facilities alone are woefully below even minimum needs and constitute a constant threat of illness, even epidemic. Wildlife administration has to be done on the sketchiest basis today. There seems to be no logical reason why a portion of the income derived from the National Forests, which belong to all the people, should not be made available to care for the interests of the large percentage of our population that finds recreation in these areas.

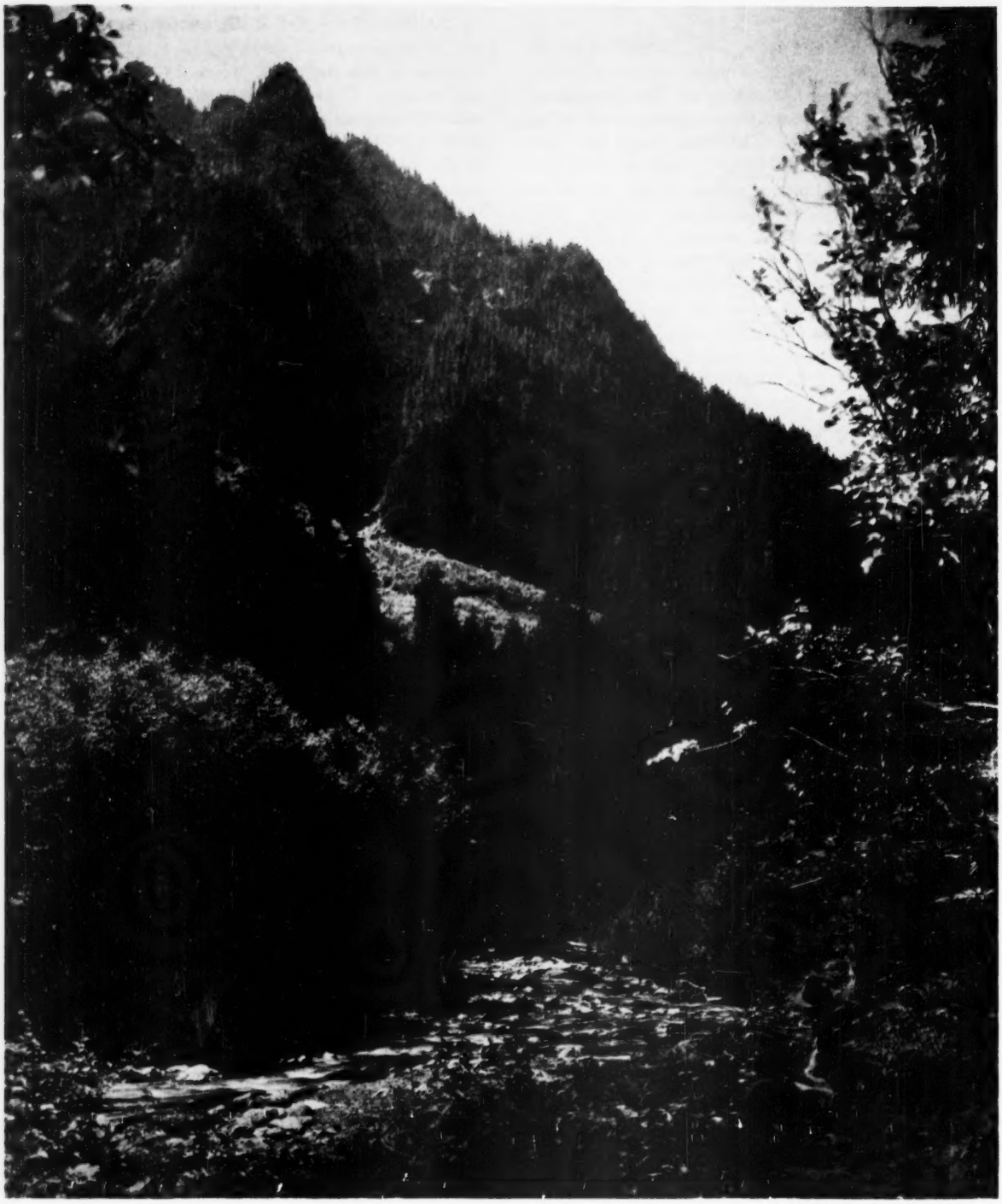
MICHIGAN has become the second State to extend protection to all hawks and owls, following the example of Connecticut, which took such action in 1951. The Michigan Legislature acted after an extensive educational campaign, and there was only one dissenting vote when the role of legislators was called. Governor G. Mennen Williams signed the bill immediately. A survey by the National Audubon Society reveals that only nine States fail to protect these birds in some way. Most States protect all but a few species, since the important place of the predaceous bird in controlling rodent populations is now recognized. It is also being realized that excluding three or four species from protection results in the killing of many of the beneficial kinds, and all, actually, have habits of life fully as beneficial to man's interests as they are detrimental. It is to be hoped that the number of States extending full protection to hawks and owls will grow rapidly.

CALIFORNIA'S mountain lion population amounts to an estimated six hundred adults, and these numbers are being maintained at about that figure, or possibly gaining slightly, according to D. D. McLean of the California Department of Fish and Game, writing in the April, 1954, issue of *California Fish and Game*. From 1907 to 1950 the State paid bounties on 10,558 of these cats, and Mr. McLean recommends that control be continued but that extermination should not be the goal. He writes that deer make up the most of the diet of the animals, but other prey are in wide variety, including most of the animals roaming in lion country. Mountain lions do not feed on carrion. Where deer are in adequate supply a lion will take about one deer a week, and elimination of the cat in deer country results in a definite increase in the deer population. Clearly deer may increase to their own disadvantage when the lions are wiped out, indicating the predator-prey relationship. Attacks on humans are very rare, and usually either provoked or due to rabies or other physiological troubles affecting the animal. Despite the pressure of control by humans the lions persist over much of their original range, disappearing only where deer have been greatly reduced, and forests and brush destroyed. Much other interesting information is contained in Mr. McLean's article.

CONGRATULATIONS to *Virginia Wildlife*, publication of the Virginia Commission of Game and Inland Fisheries, and to its editor, Joe Shomon, on the award as the best State conservation magazine, made by the Izaak Walton League of America. This is an excellent choice, and the competition is keen because the physical and editorial character of these magazines has improved vastly.

ON A plaque attached to a stone in Redwoods State Park, Del Norte County, California, there is the following inscription: "To Jedediah Smith, referred to as Bible-Toter, first white man to cross from the Mississippi to the Pacific, thus starting the train of events which made California the 31st star in our flag. This grove on the Smith River (which he discovered in 1828) dedicated to his memory by Mr. and Mrs. C. M. Goethe of Sacramento and by the State of California." This grove was, indeed, started by a gift from the Goethes, and expanded to include the entire sixteen miles of redwoods along the Smith River. Mr. Goethe writes us that he was surprised to see this inscription, together with a drawing, reproduced in a newspaper feature called "California Sketches" and drawn by Carl Somdal. Democracies, he writes, tend to forget their heroes and might easily have forgotten "that brilliant intellect that made possible the United States becoming a transcontinental power." Mr. Goethe also says that, with Mrs. Goethe, he covered much of the trail followed by "Bible-Toter" from the Ohio headwaters to the second massacre of Smith River. He tried to have Folsom Dam, or the lake behind it, named for Jedediah Smith. This was not done, but, at least, a redwood grove commemorates one who made great sacrifices in the building of our Republic. Jedediah Smith receives no mention in the encyclopedia on our office library shelves, so perhaps we do, indeed, forget our heroes.

R.W.W.



PHOTOGRAPH BY ASAHEL CURTIS

The trail along the river in the canyon of the Quinault in Olympic National Park.

PHOTOGRAPH BY PATSIE SINKEY, WASHINGTON STATE GAME DEPARTMENT

State Game Protector Boyd King of the Olympic Peninsula makes it a hobby to teach boys how to fish correctly and to love and protect wildlife.

Nature's Healing Touch

By ERLE HOWELL

PUTTING into creel the last trout the law allowed, my son and I started at noon to our car, walking along the rocky bed of the South Hoh River on the western slopes of the Olympics. Touching the boy's arm, I signalled him to stop. "Bear!" I whispered. Seventy-five yards down stream a black bear that must have weighed two hundred pounds was fishing for salmon. We froze in our tracks to watch, but purposely continued to talk. In shallows, when first sighted, the bear waded out into water so deep that it covered his back. After two or three unsuccessful passes at a fish, the animal, apparently hearing our voices, began to search our shoreline with his eyes. Half-heartedly continuing to fish, he could not get over the idea that he was being watched. At last, unable to take it longer, he left the water, ambled thirty feet across the rocky beach and sat on a two-foot ledge marking the boundary between streambed and forest. Facing in our direction, he searched uneasily for us. When we moved the bear spotted us and disappeared in the brush.

Although the animal did nothing even so dramatic as to capture a fish before our eyes, the experience was of deep significance to us. My son's spontaneous pleasure told me that four years in the armed forces had not robbed him of love for the simple things of Nature. During the preceding twenty-four hours he and I had been fishing in the rain forest just outside the Olympic National Park. On either side of the stream huge Sitka spruces lifted their heads aloft, spreading their branches in perpetual blessing. Sheets of moss hung from the spruce limbs and covered the ground, providing a soft mat under foot. The undergrowth included vine maple, willow, young spruce, hemlock, huckleberry, and sword fern. Roosevelt elk, while wintering, had browsed the shrubs of the lower story to a height of six or eight feet, leaving a comparatively open area beneath the shelter of the arboreal patriarchs. This was our first outing together since the young man's discharge from the service, and he often called my attention to the beauty of the region. I rejoiced inwardly, not alone because I, too, felt the charm of the surrounding scene, but because of the happiness it brought my son. He and I were testing again the age-old power of the forest, and the living things dwelling there, to heal the mental and spiritual scars of struggle with the artificial world of man.

The forest contains many stimulating secrets, and one does not need to be a trained scientist to persuade the wilderness to reveal them. One requires only curiosity, an observing eye, and patience. Bird-watching early one morning on a tree-flanked road, I saw a pair of courting purple finches dancing in the roadway a few yards away. The male, facing his mate a yard off, lowered his quivering wings, and, balancing upon his toes, began his love dance. Rapidly lifting each foot in turn, the tips of his wings almost touched the ground with every vibration as, with head extended toward his intended, the bird danced with abandon. After a period in which she appeared unaware of the elegant performance, the female, with head extended, charged viciously as if in anger. The male, continuing the performance, held his position until the other was only inches away. Then, leaping lightly aside, the

PHOTOGRAPH BY THE AUTHOR

Whistling marmot photographed among some old blow-down timber at Deer Park in the Olympic National Park in Washington State.

dancer came to ground, facing his mate with motions uninterrupted. The show went on as, for a few minutes, I enjoyed first-rate entertainment, offered by dancing stars, and without admission fee. I was in my study in ample time for my day's work, and with mind refreshed to pursue it.

It was through patience, combined with good fortune, that I discovered the method by which the western winter wren accomplishes the ventriloquial feat of apparently throwing his voice when singing. Early one spring morning, with ground and air full of frost, I was standing motionless among young Douglas firs. I heard the rippling notes of my friend. Pulling all stops, the wren released the cataract that is his song. In characteristic style, one note seemed to issue from a point at my left, and the second to originate from the right, and the next from in front of me. Without moving my body I searched the brush as far as my eyes could turn. Shortly, I saw the bird perched upon a horizontal limb thirty feet away. With head thrown back and beak open, he lustily sent forth his melody. His breath, chilled by the frosty air, came forth in little puffs of steam, as if issuing from a boiling teakettle. Meanwhile, the deceitful creature turned his entire body, first in one direction, and then another, giving the impression that his various notes originated in different places. The vocal illusion thus created was as complete as that of any comedian-ventriloquist. The satisfaction of having solved one of Nature's mysteries made my work in the town a little easier during the following week.

PHOTOGRAPH BY THE AUTHOR

A snowshoe rabbit pauses while lunching on lupine and poses for its photograph.

To my mind one of the greatest bird architects is the bush-tit, resident the year round in western Washington. This bird, about four inches in length, builds a hanging nest from eight to twelve inches long, with a tiny opening at the side near the top. Woven of moss and lichens, the lower one-third is enlarged and filled with plant down, providing a comfortable swinging cradle for the five or six eggs. Admiring these skillfully constructed homes, I had often wondered just how the tiny engineers go about building them. Then, one early April, I found the answer. Observing a feathered mite with a bit of moss in its beak, I watched its movements until it paused near the end of a cedar branch and began weaving the threads about the twig. Close observation revealed that a small quantity of the building material had already been entwined about the end of the limb, which was ten feet from the ground. For some time I watched the busy builders at their work, and saw the nest gradually grow. When the supports were securely attached to the limb, the birds began to construct the down-hanging part, much as a woman knitting a sock attaches one stitch to another to form a completed garment. Leaving the scene, I returned the following Saturday and found the nest completed. Again I experienced the healing contentment that comes from having solved one of Nature's secrets.

Some of our family's most cherished memories of the outdoors have to do with the wild creatures encountered there, and the riot of color displayed by flowers on lofty meadows. The friendly chipmunk that nibbled bits of carrot at our feet at Deer Park, high up in the Olympics, and the snowshoe rabbit that, at noonday, fearlessly fed on lupines at the same camp, added a touch of warmth to our day, more personal even than the snow-capped peaks, and more intimate than the waterfalls. The Olympic marmot that posed for his picture on a hoary log near the park highway offered simple pleasure to the family, to be remembered along with the far vistas of the Strait of Juan de Fuca, the San Juans, and Vancouver Island, in view from the same elevation. The picture of alternate white, yellow, purple, and lavender of avalanche lilies, dog-tooth violets, mountain phacelia, and alpine phlox, displayed on Hurricane Ridge, will remain always to brighten our thoughts.

PHOTOGRAPH BY THE AUTHOR

A field of avalanche lilies growing on Hurricane Ridge in Olympic National Park

Many men who hunt and fish with enthusiasm often find that the by-products of their quests are more rewarding than the achievements of their first objectives. I have found this true on many occasions. The first nest of the water ouzel I ever saw was discovered by chance while fishing for trout in Salt Creek, a small stream that flows into the Strait of Juan de Fuca. Where I stood just below the falls the ground was at water level, but immediately opposite was an embankment twenty feet high. Hearing the call of young birds giving thanks for food, I glanced across the water and saw a parent dipper withdrawing from what appeared to be a large ball of moss fastened to the gravelly cliff-side. Crossing the stream, I climbed the hill and lifted the hinged door of the nest. Four fully-fledged young water ouzels exploded into my face. Two flew across the stream, while the others came to rest in the foaming current below the falls. I was astonished to see the birds, out of the nest for the first time, swim away as readily as young ducks. Making their way to a sandy beach across the water, they climbed ashore, hastening to find shelter in the nearby brush. I do not recall how many trout I took that day, but I shall always remember the young dippers with a rewarding sense of expanding friendship.

Fishing in the Toutle River, which flows from the Cascades to empty into the Cowlitz in southwestern Washington, I saw the oddest thing I ever knew a deer to do. Three of us were standing in the edge of the swirling current, which for two hundred yards roared along in a succession of rapids. A doe approached from upstream in the middle of the river, apparently running with the current. With body immersed and head held erect, the animal leaped periodically and, swept forward by the boiling current, touched bottom again farther along the stream. Passing us, the doe showed no signs of awareness of our presence, but, continuing what appeared to be a lark, disappeared around a bend in the river several hundred feet downstream. I remember clearly that on that day the fish were not taking the fly, but the sight of the playing deer brought ample reward.

Fortunate is he who acquires love for the creatures of the wild early in life. Charles Bowman Hutchins is such a person. He has served as naturalist in two national parks and preached the gospel of conservation in more schools and churches than perhaps any other man in America. In early childhood, living on Queen

This is believed to be the largest Douglas fir. Its circumference is 53 feet, 4 inches, measured four and one-half feet from the base. The tree grows near the Queets River in Olympic National Park.

PHOTOGRAPH BY THE AUTHOR

Anne Hill in Seattle, Charles, keenly interested in birds, showed a remarkable talent for whistling their songs. Churches and schools, becoming interested, asked him to sing the songs of the feathered creatures and tell of their habits. His program attracted such wide attention that, at the age of nineteen, he took his first extended trip throughout the United States and for more than forty years has done nothing but tell the story of birds, paint their pictures, and sing their songs.

The healing fellowship with the creatures of the wild is not alone for youth, but for the aged, as well. Having learned of the illness of Harry, a doctor friend, I went to see him. Although he met me at the door, his unhappiness was evident. Quite in contrast with his usual cheerful attitude, he was despondent. "Because of my age and health," he said, "I have got to quit the practice of medicine. The prospect of inactivity scares me. I have always thought my work was all I needed, but, now that I've got to give that up, I can see my mistake in developing no outside interest."

"See here," I said, "you are perfectly situated for a hobby that will keep you busy without leaving your own garden. "You can thank your wife for preparing the way for you. That garden of yours is one of the town's finest. Look at all those perennials and shrubs, and the hawthorns and other trees along your parking strips. And you have a fish pond and a bird bath outside your living room. Get yourself a bird book and enjoy identifying the feathered guests that play, sing, make love, build nests, and raise their families at your door?"

A few days later, calling to deliver the handbook my friend asked me to bring, I found he had erected a feeding tray outside his window. Juncos, song sparrows, and chickadees had already begun to make regular visits to the new source of food. The doctor was filled with questions about the identity of the birds he saw daily in his own garden. Thanksgiving afternoon we went to see the purple finches and cedar waxwings I knew would be feeding on the berries of mountain ash in a cemetery outside of town. As the doctor observed the variations in the plumage of the different species I could detect a new sparkle in his eyes, a fresh tone in his voice, and a new interest in life. Nature was performing her sure work of healing, as has been the case with so many.

In March a northern violet-green swallow flew into the doctor's attic, through an open window, killing itself in the attempt to escape. Finding the dried remains of the bird, some time later, the now thoroughly enthusiastic bird student identified it from his handbook, placing it in a glass container for future reference. In April a pair of bush-tits hung their long nest to the lower branches of a hawthorn on his parking strip. Passing his house and observing the suspended cradle, I went in to call my friend's attention to his good fortune. To my delight he had already found the nest and identified the builders. Now I knew no one could rob the doctor of his all-consuming interest in the fascinating world of Nature.

Moving away from the town I did not see my friend again until some years after his retirement. When I met him, he took my hand and, looking earnestly into my eyes, said with evident affection, "I can't thank you enough for suggesting bird-study to me."

Looking the doctor over, I observed that he appeared younger and more robust than when last I saw him. He was so fresh and agile that I asked, "Are you practicing medicine again?"

"No," he replied, smiling significantly, "I'm too busy."

The good doctor, experiencing the healing touch of Nature, had responded favorably to its therapy.

Are Tornadoes Growing Worse?

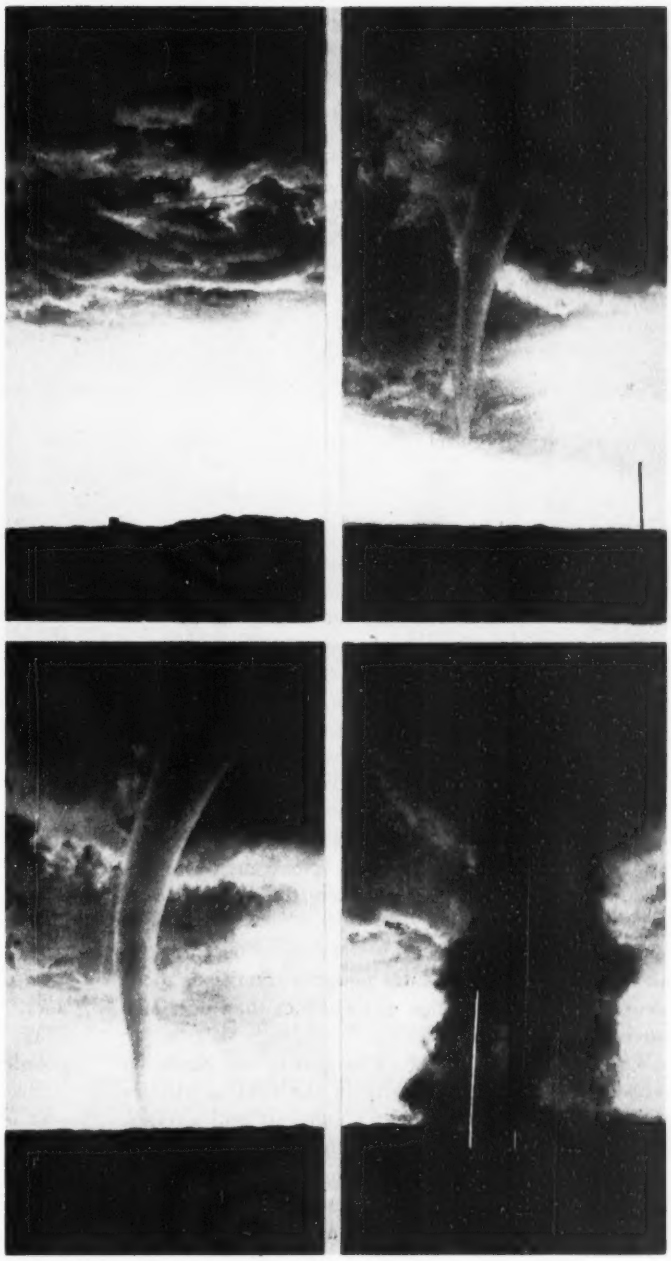
By EDNA HOFFMAN EVANS

IT WAS in 1916 that the United States Weather Bureau began keeping books on tornadoes, so there is now a fairly good basis on which to judge the vagaries of such violent phenomena, and whether they are increasing in frequency and destructiveness.

At first glance, the figures seem to indicate that the twisters are getting worse. In 1916 there were 86 tornadoes reported, with the loss of 140 lives, and property damage amounting to $2,511,500. In 1951 tornadoes numbered 305, and, while there were only 33 lives lost, the property damage amounted to $30,897,350. Neither of those years was an "average" one, for during the 1919-1951 period the annual average was 153.0 storms, resulting in 222.1 deaths, causing property damage amounting to $14,-092,369.

A jump from 86 to 305 tornadoes a year looks ominous. But, since 1916, facilities for the rapid communication of such damage have improved. Empty spaces on the map have been filled up to a surprising degree. There are more people to see tornadoes today. Word of a twister in Kansas or Oklahoma is on the radio and on the front pages of newspapers, from Maine to California, almost before the funnel-shaped cloud has whirled itself away. Even though a twister does occur in an isolated area, the chances are that some airplane pilot will spot it from afar. It is pretty hard for a tornado, or any other unusual phenomenon, to remain unknown these days.

As for the great increase in property damage, there is also more property to be damaged. And it is well nigh impossible to compare the dollar values of today with those of thirty years ago.



The birth of a tornado. First the ominous clouds, then the funnel cloud forms; it reaches down toward the ground; it hits with violence and continues on its way.

There is further evidence that increased thoroughness in reporting, rather than greater annual severity of the weather, is responsible for the apparent rise in storm totals. As long as Kansas (a State well known for tornadoes) depended on Weather Bureau reports and newspaper accounts for its annual storm total, the yearly average was 18. In May, 1951, the services of a clipping bureau were employed and accounts of 106 Kansas tornadoes were collected, more than twice the number officially reported in any previous year. While records show that 1951 was a remarkably wet year, and tornadoes are usually associated with wet spells, yet the difference in number was too great to be explained by weather conditions alone.

Cities having permanent Weather Bureau offices generally report more tornadoes than do localities where no such records are kept. For example, Oklahoma City and Cincinnati have both reported eight tornadoes within their limits during the past 37 years. Fort Smith and Little Rock have both reported seven, Chicago and New Orleans, six. There are no such records available from rural areas, or from towns lacking Weather Bureau offices.

While the region east of the Rockies is generally

U. S. WEATHER BUREAU PHOTOGRAPH

Tornado damage runs into the millions annually. This is what a twister did at the Warner Robins Air Force Base near Warner Robins, Georgia, in 1953.

considered to be the "tornado belt" of the United States, no State can claim complete immunity from the twisting, roaring winds. They can occur at any time of the day or night, and at any season of the year in which conditions are right for their formation. Nor does the United States have a monopoly on tornadoes. They have been reported in many parts of the world, chiefly in the north and south temperate zones, from Canada, England, France, Holland, Germany, Hungary, Italy, Australia, India, Russia, China, Japan, Bermuda, and the Fiji Islands. The storms may not always be called tornadoes—the French word is *tombre*, while the Russians call the storm a *smerch*. None the less, from descriptions of the storms, it is easy to recognize them as tornadoes.

It is true, however, that the region east of the Rockies in the United States presents conditions more favorable to the formation of tornadoes than does any other region in the world.

What causes tornadoes? The answer can easily be oversimplified. One authority in the field of physics of the air lists no less than 26 conditions and circumstances normally associated with tornadoes. Forecasters for the U. S. Air Force's Air Weather Service describe six different characteristics in the synoptic situation before they will predict a tornado.

Generally speaking, tornadoes are held to develop when cold, dry air, moving from a westerly direction, overruns abnormally warm, moist air moving from the south or southwest. This contact takes place somewhere between a half-mile and a mile above the surface of the earth. There the warm air, which is lighter, rises rapidly through the cold air. This great uprush cools the moist air and condenses part of its water vapor, releasing latent heat that adds to and maintains the energy of the storm. Another theory holds that the violence derives from columns of cold air that pour down from clouds.

Contact of polar maritime air from the west or northwest with tropical maritime air from the south or southwest usually provides the right conditions for the formation of tornadoes. The region east of the Rockies is an excellent setting for such meteorological activity, for it is in this area that warm, moist air from the Gulf of Mexico and the Caribbean meets the cold air from the Pacific when, after losing much of its moisture, it descends the eastern slopes of the mountains.

Despite the fact that much is known about conditions that cause tornadoes, the Weather Bureau cannot "pinpoint" its predictions. That is, while it can isolate a potential region where such storms may occur, that region may cover anywhere from 5000 to 10,000 or more, square miles. The chance that any one given area will be subject to a tornado is rather small.

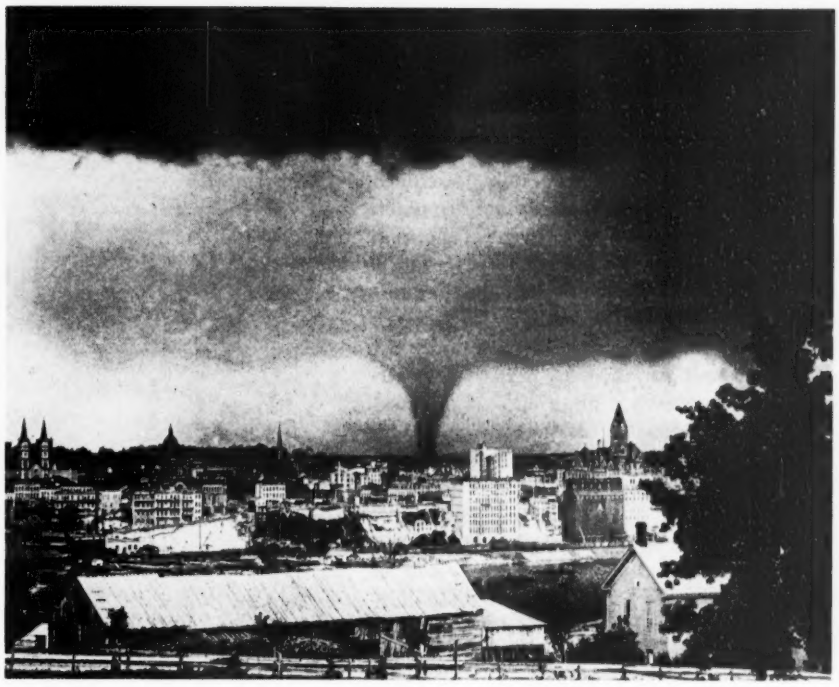
It was for this reason, and for fear of causing panic or needless alarm over a wide area, that the Weather Bureau hesitated for years actually to forecast tornadoes. The nearest it would come, before March of 1952, was to predict severe thundershowers and the possibility of hail.

However, during World War II, considerable concern was felt for the safety of air bases, war plants, and human lives in the tornado belt. Wide area warnings were of no value; the information had to be localized. So the Weather Bureau and military personnel joined forces in setting up a network of reporting stations covering an area 50 to 75 miles west and southwest of areas that might be harmed by tornadoes. People whose jobs kept them outdoors, or who could look out of the window frequently, and who also had access to a telephone, were enlisted as observers. Telephone operators and merchants in small towns, gas station attendants, housewives, farmers, state police, and utility company field men, all kept a weather eye out for the characteristic funnel-shaped cloud that heralded the approach of a tornado. Their reports were sent to key points from which warnings were relayed. Even a few minutes' warning has helped save lives and property in the path of a severe storm.

So successful was this wartime warning system that the Weather Bureau has continued and expanded it

in recent years. Now there are 26 such networks in the 21 States where tornadoes are most frequent. There are still vast areas not covered, however.

Beginning in March, 1952, the Weather Bureau began issuing tornado warnings covering potential areas of from five to ten thousand square miles, or larger. Public reaction was found to be favorable, and thus regular tornado warnings have been added to the list of special Weather Bureau services. The general warnings, it is felt, serve to keep people in the threatened areas alert, without causing them undue alarm. When the danger has passed, a statement to that effect is issued promptly.



PHOTOGRAPH FROM EWING GALLOWAY

The Lake Gervais twister of 1890 as seen from St. Paul, Minnesota.

Once a tornado is on the way, nothing man has yet been able to do can stop it. It is often regarded as the most destructive type of storm. The damage it does is instantaneous and complete, and survival is a matter of chance unless persons in its path can find adequate shelter. Some students of tornadoes, however, contend that a twister can be stopped by puncturing it with explosive missiles from jet aircraft, hitting the tornado at its cloud ceiling.

The tornado is a member of the whirlwind family, as are the hurricane, the waterspout, and the dust whirls or "dust devils" of the plains. Which of the two relatives—the hurricane or the tornado—is more destructive is a debatable question. The hurricane is more widespread, lasts longer, and covers a greater area; but the destruction in the narrower, shorter path of a tornado is usually more complete.

Winds in the tornado usually whirl in a counterclockwise direction in the northern hemisphere and in a clockwise direction south of the equator. While no accurate measurements have ever been made, it is estimated that tornado winds often reach velocities of from 450 to 500 miles an hour. They may not always be so violent, but even winds of 150 to 200 miles per hour can do tremendous damage.

The most noticeable characteristic of the tornado is the funnel-shaped cloud that dips downward from the cloud layer above. Destruction begins when this funnel reaches the ground. So dynamic are the forces of the wind currents that they cause a partial vacuum at the center of the whirling cloud. Because of this vacuum, pressure from inside buildings actually causes them to "explode," tossing more wreckage to the mercy of the rampaging winds.

Generally speaking, tornadoes travel from the southwest toward the northeast, leaving curved paths behind them. But the twisters do not always move in this manner, and on some occasions the storms have made U-turns, or even have traveled in a complete circle. Occasional storms have been observed to remain stationary for as long as 10 or 20 minutes before moving on in their journey of destruction. Nor do they always occur singly. Some areas have been struck by two or more tornadoes, traveling only a few minutes apart.

In a Weather Bureau study of 1000 tornadoes selected at random, the average cross-country speed was found to be 45 miles per hour, with the slowest storm traveling at five miles per hour, and the fastest roaring along at 65. This speed is not constant throughout the length of the storm's path, nor is the track one uniform swath of equal destruction. Indeed, the funnel cloud has been known to swoop to earth, travel for some distance leaving havoc in its wake, and then lift and "skip" a considerable area before returning to earth and destructiveness again.

The study of 1000 tornadoes showed the average length of the storm path to be 13.4 miles, with storms in the middle West usually traveling a shorter distance than those in the rest of the country. The longest tornado path on record was made in 1917 by a twister that traveled 293 miles. A study of 209 tornadoes occurring in Kansas showed them to have an average length of 10 miles.

As for the width of the tornado path, this also varies with storms and within the path of a single storm. The

swath of destruction may be as narrow as 100 feet or as wide as two miles. The average of 1000 tornadoes studied was 396 yards. Often the path of the storm is sharply defined, a fact that accounts for some of the "freak" occurrences attending tornadoes. One object within the storm's path may be totally destroyed, while a similar or much more fragile object nearby, but outside the path of the storm, may be unharmed. Sometimes, however, tornadoes are attended by violent side winds that blur the path of the actual storm.

While tornadoes can occur at any time when conditions are right, there are periods of greater and lesser frequency. From an overall standpoint, they are most frequent east of the Rockies in May and June, between 4 p.m. and 7 p.m. From a regional standpoint, March is the month when the maximum number of tornadoes occur in northern Mississippi and adjoining States; in April the zone of frequency spreads westward to Missouri, northern Texas, Oklahoma, and Kansas; May and June bring distinct maximums in the region from northern Oklahoma to southern Minnesota; July, August, and September show diminishing maximums in the same region. Thereafter, for the remainder of the 12-month period, the tornado area recedes.

In many respects the advice as to what to do in case of a tornado is markedly similar to advice in connection with the atomic bomb. The safest measure, of course, is to remove one's self from the threatened area. In case of a tornado, it is possible to move out of the path of the storm, given sufficient warning and the means with which to move fast. This, of course, cannot always be done, particularly when the storm occurs at night.

U. S. WEATHER BUREAU PHOTOGRAPH

Tornado clouds and twister photographed at Manhattan, Kansas, a State that has its full share of tornadoes.

The best protection an individual can have from a tornado is the traditional "cyclone cellar" or "storm cave" of the middle West. These structures are sunk in the ground, timbered, and covered with earth. During ordinary times they are used as storage places for fruit and vegetables.

The Red Cross recommends concrete construction for storm shelters, eight feet long, six feet wide, and seven feet high, large enough to accommodate eight people for the short duration of the storm. The shelters should be in the side of a bank or partly underground and covered with earth, near the southwest corner of the residence but not too near so that the entrance might be covered with debris. The door should be strong and the latch powerful enough to hold against the force of the wind.

Lacking a definite shelter, the southwest corner of the basement under a frame house is recommended as the safest place during a storm. Refugees should crouch there and hope no timbers fall directly on them. The cellar of a brick house is generally considered to be a "death trap," for severe storm winds can drop tons of stone and rubble on refugees crouching there.

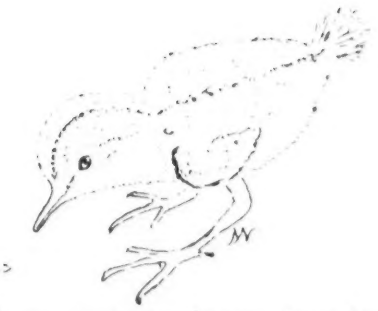
If no shelter or basement is available, people indoors are advised to lie on the floor, under furniture—any shelter is better than nothing. Outdoors, ditches, conduits, and other low places are possible places of refuge. In town, people are advised to lie down against the curb if no greater shelter is available. Remaining in an upright position invites disaster in the form of timbers, glass, and other storm-borne debris.

Except for purposes of outrunning the storm, automobiles give no shelter and persons in them in the path of a storm are advised to seek haven elsewhere. Tornadoes often have been known to catch automobiles and roll them over and over, quickly transforming them into twisted piles of junk. There is almost no limit to what the winds of a tornado can do. In several instances they have even lifted 70-ton railway coaches off the track. (Continued on page 330)

Bird Babes of Delta Marsh

By CONSTANCE NICE

Sketches by Margaret Nice



"Spotty," the sandpiper, three days old.

FOR TWO summers my mother and I had watched the hatching behavior of ducklings, Franklin gulls, and coots; this season we hoped to study some rails and shore birds. When we arrived at the Delta Waterfowl Research Station at Delta, Manitoba, on a late June afternoon, we were welcomed as parents by a little ball of coal-black fluff with a red knob on his bill and a curly orange beard. It was a sora rail hatched that morning in the incubator, friendly because it was petted soon after hatching.

"Wheeah," the sora rail, a ball of black fluff at two days.

The previous year a sora, fed on duckling diet, had faded away at the age of four days, so we were alarmed at this one's half-hearted response to canned dogfood. The next morning, with the little rail, rather wobbly by this time, in my pocket, I started out to look for insects. There seemed to be none, but by turning over boards, old laundry tubs, and such, I located a spider and a fine supply of small snails. The rail ate ravenously, as much as two and a half snails at a time, then cuddled down in my hand with a contented little *wheeah, wheeah*, seventy times a minute. His legs soon got steady and he seemed happy and vigorous. The next day he was enjoying ant "eggs," so tiny that it took three-quarters of an hour to fill him up.

"Midget," nine-day-old rail, begging.

This was just too slow, so we shifted to custard as a main dish—one egg, one tablespoon of milk and three Vi-Penta vitamin drops, beaten and baked in a slow oven until set. Eggs cooked less than twenty minutes may give birds some poultry disease.

We found coots, gulls and rails easy to raise. They eagerly snatched food from the forceps and soon were helping themselves from the dish. A fork proved handy for mashing food and feeding several babies at once. Besides custard, after the birds were well started, we fed them Gaines' dogmeal, turkey-starter, pablum, bits of defrosted fish with bones removed, and miscellaneous table scraps. They enjoyed mashed peas and carrots, cream of wheat, potato and regular pancakes, and various unorthodox and unapproved table scraps that happened to be handy. The coots and rails liked string beans, and the coots in particular had a passion for such side dishes as duckweed and lettuce.

When about four days old, "Wheeah," the rail, suffered from loss of appetite from stopped vent, apparently a fairly common ailment among young game birds in captivity. When the dried dropping was washed off, he expelled an explosive dropping and soon recovered his appetite.

We kept the little birds warm in sizable cardboard boxes under gooseneck lamps. If they tried to crawl under one another, we brought the light lower. Setting their water-jars upside down in saucers kept them from becoming water-soaked, a hazard to young birds. I used to put their bills into the water for the first drink and at intervals until I was sure they knew where the water was.

"Wheeah" was soon joined by a superabundance of baby coots and Franklin gulls. Although these were considerably bigger, he got along well with them.

We were lucky enough to discover three nests of shore birds near the hatchery. We borrowed a pipping egg from the killdeer nest near the duck decoy, watched the amazingly precocious little bird for seven hours after hatching, then, after locating the day-old brother from the roof of the lodge, placed our baby a few feet away. Before we could regain the roof, a parent was hovering the new arrival.

We repeated this method successfully with three killdeer eggs from another nest, leaving one or two eggs or young with the parents. We did not keep any of these delightful babies because we did not believe that, in the insect-poor Delta region, we could raise birds that must have their own insect food from the beginning.

Twenty days after the discovery of a spotted sandpiper's nest the eggs were pipped, and we put one in the incubator. The next morning we were dismayed to find the nest empty, with only a few pieces of eggshells nearby. Some predator had found the hatching eggs. The little father returned once to carry away the shells, but spurned the enormous addled gull egg we placed in the nest to comfort him. So we were left with an orphan sandpiper and the problem of parents.

She was a dainty, long-legged little thing, much like a tiny killdeer. When still damp from the egg and not yet strong enough to stand up on her tarsi, she gave a little teeter. A few hours later, she was pecking tentatively at amphipods, and the next morning she was delighted to pick up and eat dead gnats and mosquitoes that I had caught on the screens.

The baby killdeer one-half-hour old and, below, five hours old.

This day a new sora hatched, so tiny that we named him "Midget." The next day we added a newly hatched coot, hoping she would serve as a kind of nursemaid to her smaller companions. Coots are rails, and the adults are dressed in sober gray, but their babies are fantastic creatures with bright red bills and bald red and blue crowns, orange whiskers and orange tips to their black down. "Cooty" proved a devoted comrade to her little friends, but her appetite was so great and her reach so long that she greedily snatched all the best tidbits. We often removed her temporarily until "Spotty" and "Midget" had had their share.

Stimulated by her companions, "Spotty" soon progressed to eating flakes of pablum and bits of dog food and custard and toast crumbs, either on the floor or from forceps. Insects were a special treat and all enjoyed small, shrimplike amphipods and spot-tail minnows or shiners that swam in a bowl. Sometimes I took them on fishing expeditions to the airplane dock and fed them amphipods, minnows and water boatmen from the cornpopper, with which I caught them.

It takes an enormous number of gnats, mosquitoes, fish flies, and the like even halfway to fill up a tiny bird. When I held the sandpiper up to a screen, she ate twenty-five insects before she became restless at being held in my hand; the rail ate about nineteen, and each took eight or nine apiece on a second round, and still could eat custard avidly on their return to their box. Another day the coot cleared the screen of forty-nine insects in one effort. I never gave them house flies, because once a fine little red-winged blackbird of ours died in convulsions after eating two presumably DDT'd flies.

The baby coot begs for food, and, at fifteen days the baby coot is still begging.

When the young birds were about three weeks old, "Cooty" ate 149 marsh flies and other small insects—dead or alive—in succession. Midget ate fifty-eight at the windows, showing a preference for live prey.

When she was two and three days old, I let "Spotty" forage along the shore near the nest of her family. She went at this fascinating work with low twitters and some teeters, picking up infinitesimal insects. At the appearance of another person she fled with loud alarm notes. I was only able to call her back by saying soothingly *weet-a-weet* in imitation of her own call and scratching the ground with my finger.

The next day she took refuge under a forest of nettles and I had to crawl in after her on my hands and knees. After that we put her and her companions out in sunny weather in a small enclosure in the duck yard. Such a bird of the open, depending on hair-trigger reaction to danger, speed in reaching concealment, and protective coloration when "frozen," would naturally be more nervous than the rails that normally live in or next to a jungle of reeds.

"Spotty" did not have the attachment to the two rails that they had to each other. After all, little shore birds do not depend on their parents for food, but only for warmth and warning. We never saw that the little wild killdeers tried to keep near each other. If we let out "Midget" and "Cooty," the former explored about happily, while Cooty, crying that she was lost, tagged behind as closely as a fat, awkward bird could follow a small, agile one. Later, when free near the pen, "Midget" would rush down the sidewalk, flapping his little wings, and disappear into the weeds, while "Cooty" would sit on the laboratory doorstep—a perilous spot—and wail.

When "Spotty" bathed, as she was fond of doing, her wet feathers would cling to her body, her eyes popped out, and she looked more like a reptile than a bird. Once, when the birds were about two weeks old, "Midget," who had been behind the water jar, was confronted with this extraordinary looking sandpiper. He started to attack her fiercely, apparently under the impression that he was defending his home from a dangerous stranger. I hastily removed him and returned him only when "Spotty" had regained her sleek and elegant contour. Then these were friends again.

In time "Spotty" became so large that we concluded she must be a female. Her breast and wing feathers had begun growing almost at the start. At two weeks her wings could lift her two inches off the ground. Four days later she discovered she could fly. Immediately she was out of the

pen and running and teetering happily along the edge of the duck pond. However, about dusk, "Spotty," crying *weet-weet*, ran ahead of me towards home and food and coyly allowed herself to be shooed into the pen and caught. This happened every evening but one, when we forgot her. Next morning she was waiting at the door for breakfast. She had gained no weight in her busy days of foraging.

"Spotty" at five days, and "Midget" at four.

Without her father to lead her into more fruitful territory, we feared she would not succeed in becoming fully independent by the age of twenty-three days, the date on which we had to leave Delta. Dr. Theodora Nelson had found that father spotted sandpipers normally stay with their young for a month.

The director of the station, Albert Hochbaum, had given us unfailing kindness and co-operation. He now arranged for a permit for us to take our three most valuable birds with us, and his helpers fixed for us an elegant two-compartment, miniature, cardboard Pullman, complete with wire false floor and airholes. When we opened the box on the train at mealtime under a swathing of mosquito netting, a little black head instantly appeared. "Midget" wriggled his way out and stood contentedly in my lap. "Spotty," lonely, flew to the top of the partition and moved in with the young eared grebe, who did not object until the sandpiper stood on her back with wet feet!

"Midget" was just as tame and affectionate as "Wheeah," who had died from a fall at the age of twenty days. When he was little and still downy, he would, when we were seated, climb from our ankles to our shoulders, holding on with his clawed thumbs, and cuddle in our hair. Suddenly, when twenty-four days old, two days after we reached Chicago, he became wild; perhaps he had reached the age of independence from parents.

"Midget" is now enjoying the bamboo thickets, marsh and wading pool of the shore bird exhibit at the Philadelphia Zoo. He is bolder than most of the other rails—two adult soras, a Virginia and a clapper—in leaving the wilderness to explore the open.

"Spotty," on her introduction to the shore bird community, was pursued by the pair of snowy egrets and had to be rescued and placed in a small bird exhibit that has a running brook. She sometimes teeters, a sign of excitement, while picking up food. Usually she seems content to stand on one leg and doze, since hunting prey can no longer be her chief occupation and amusement. The brook is useful for washing food, and the pool for bathing.

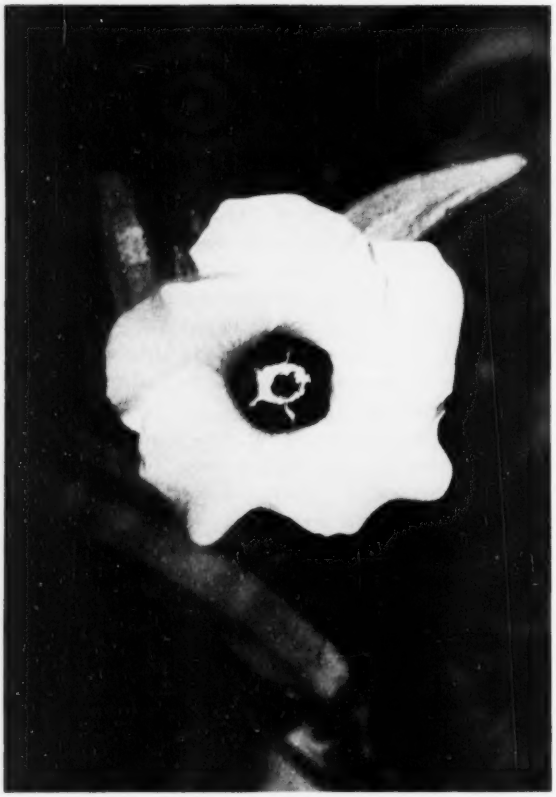
★

Let's Go Fishing

By MABEL IRENE HUGGINS

HERE is sport for the Izaak Waltons. Can you fill your creel from the watery places where fish abound? The clues suggest the varieties you should hook. Some will be too large for a fisherman's basket. Answers on page 332.

1.	fish	a percussion instrument
2.	fish	pays on delivery
3.	fish	the center of the solar system
4.	fish	a celestial being
5.	fish	a domestic pet
6.		an astronomer
7.		a long, iron-pointed pole
8.	fish	a bowman
9.		a native of Illinois
10.	fish	a mender of shoes
11.		a roost
12.	fish	a kind of metal
13.		part of a shoe
14.	fish	a bison
15.	fish	opposite of black
16.		linden
17.		a deep gutteral sound
18.	fish	a part of some vessels



The newly opened okra blossom five minutes before a leafcutter bee came with her snipping mandibles.

The Ways of the Leaf-cutter Bee

By RALPH J. DONAHUE

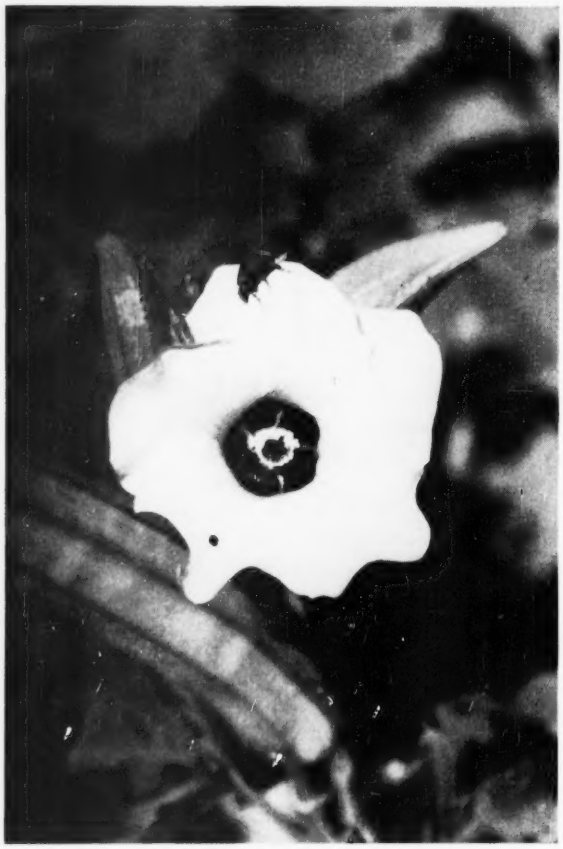
Photographs by the Author

"Look here!" my flower-growing neighbor reprovingly called to me one July morning. "See what your Mega-children are doing to my prize glads!"

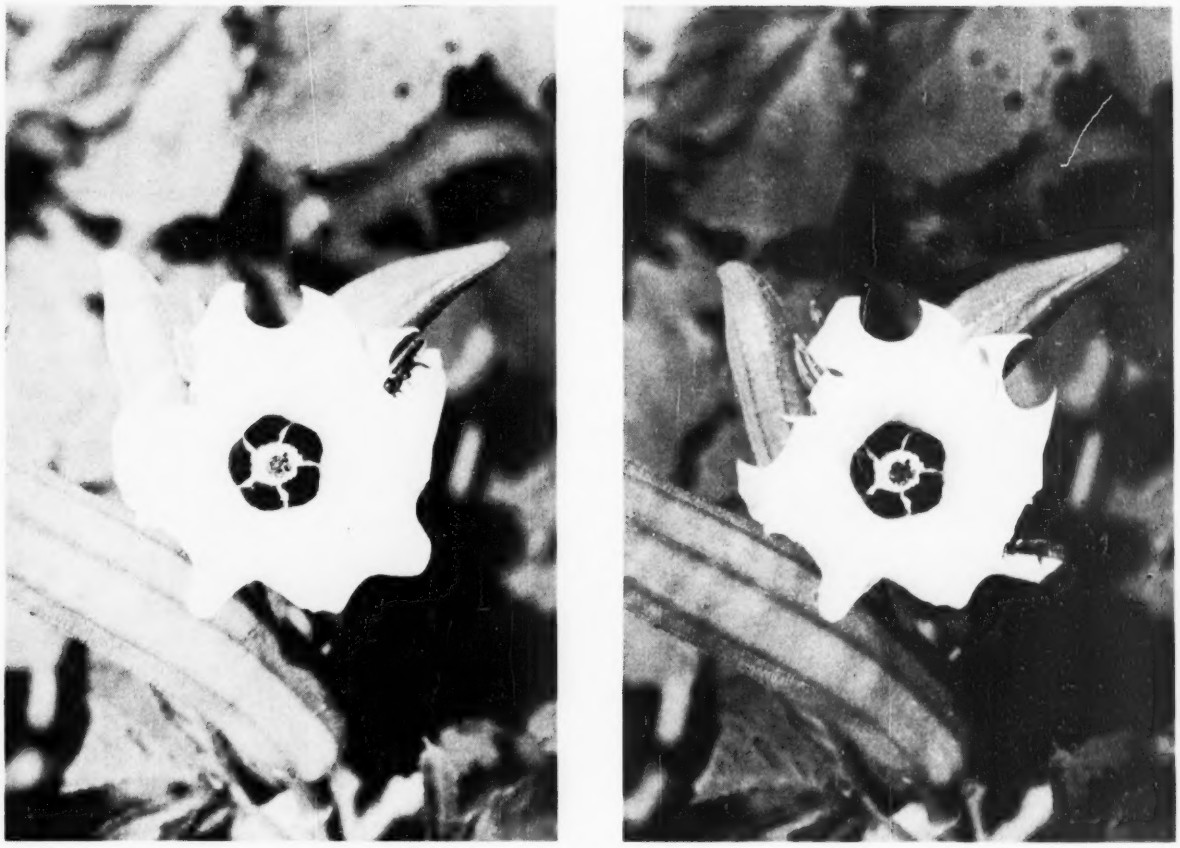
Earlier, a leaf-cutter bee being observed at work, I had identified this solitary bee for her as *Megachile brevis*. Sure enough, the petals of several of the salmon-colored glads bore circular indentations about the size of my finger nail. As she had planned to enter these fine spikes that afternoon in a flower show, she was ready to do battle to protect them, with everything from a ball bat to a fly swatter. In fact, I later saw her standing near her flower bed with a fly swatter in her hand. Later, when the judges had rendered their decisions, she showed me her honorable mention ribbon. "I would have won first prize if it had not been for your old bees," she said with a reproving emphasis.

More than likely my flower-loving neighbor was right. But Madam Megachile, the leaf-cutter bee, had no concern with flower shows. The bee was only following a behavior pattern, gathering the lining of her several flower-fragment cradles. To her the prize glads were no more important than the nearby wild rose, from which she, or another of her kind—a few days earlier—had clipped generous petal portions. What *did* matter was that the glads were within range—about 250 feet—of her nesting territory. And gladiolus petals make satin-like linings for a young bee's bed!

Quite by accident I found the nest of the insect that had been troubling my neighbor's flowers. Just outside our line fence, where the vegetation had not been cut back the season before, several erect old stalks of thistles still bore shriveled packets of last year's seed. In clearing out this area, the day after having been chided about my bees, a thistle stalk broke apart as I grasped it. There, in the pith-hollow interior of the dry weed, I found a still uncompleted triplet-cradle of Megachiles. It was being made from parts of rose leaves and petals from flowers. The latest additions were none other than salmon-colored clippings



***Megachile brevis* begins her first cutting of an okra blossom petal.**



On her second visit to the blossom the bee can be seen rolling the fragment of petal upon which she stands, while, on her fourth visit (right) the bee is about to cut free the petal fragment.

of gladiolus!

Since I had already damaged the nest-stalk, I opened it to examine the work of the bee. Two inches of the hollow interior of the thistle stem, just below the point where it had snapped apart in my grasp, had been lined with green sections of rose leaves. Next were several layers of flower petals, mostly of rose and gladiolus. This tube-like enclosure was blocked off by three partitions, one of which formed the bottom of the lower cell. The others enclosed areas about a quarter of an inch long. The third cell was, as yet, unfinished. The completed cells each held, upon a sticky mass of pollen, a single, glistening egg.

Here was proof of the use to which the leaf-cutter bee was putting the pilfered flower petals. Here, according to Dr. Charles D. Michener of the Department of Entomology, University of Kansas, unless a parasitic interloper bee (*Coelioxys*) creeps in and takes over, to the destruction of the first dweller, within three days the infant *Megachile* will hatch. For about a week the bee-grub will live on the nectar-sweetened pollen provided for it by the mother bee. Then it will spin a double-layered cocoon of brown silk. Enclosing itself in this cocoon, it will await the magic transformation that makes a legless grub into a winged bee.

This pupal life normally, is something under two weeks. The length of time required for emergence into the world of wings, however, depends on the season. Those larvae that reach the "sleep" stage in the fall continue to snooze until the following spring.

But *Megachile brevis* does not always select standing weed stalks for nesting sites. Dr. Michener writes, in his *Biology of the Leaf-cutter Bee* (University of Kansas Science Bulletin for November, 1953), that prostrate stalks of horseweed, sunflower, pokeweed and even corn stalks, are more commonly used. However, he has also found this bee's nests in holes of old wood, curled up in leaves, under clumps of grass, and in holes in the ground.

Last fall, after returning from a weekend absence, I found a leafcutter bee had selected yet another place for a nest. In one of the several rolled-up issues of the *Kansas City Star* that had accumulated on our lawn while we were away, I found the bee and about a dozen petal-cuttings from pink petunia and red cosmos. It was sundown when I unrolled the paper, and it was evident the insect has elected to remain with its nest during the night. Dr. Michener tells me that he has found that female bees do this while nest building. At other times they, like the males, sleep wherever night overtakes them.

Not all flowers are used by the leaf-cutter bee as cradle linings. My own observations include, besides the petal sources already named, such blossoms as hollyhock, tickseed, and okra. Dr. Michener has a more extensive list, which includes leaves of several clovers, lespedeza, alfalfa and buckbrush; as well as petals from the partridge pea, white evening primrose, and cultivated zinnias.

This bee's choice of flowers and leaves is thus varied. Its behavior, sometimes, is no less so. Because the flowers of a certain plot have been cut by the bee one day, is no assurance that the insect will return the next. Sometimes, during a series of trips to a particular flower bed, *Megachile* will, for no apparent reason, decide to move her snipping to an area in the opposite direction.

However, once a cutting place is located, it usually requires only a short wait for the insect to return for more cutting. Nor does it take particularly sharp eyes to see that she uses her mandibles as cutting tools. Usually she works with deftness and haste; cutting off the bit of petal on which she clings. As the petal falls free, the bee, carrying it beneath her, often pauses nearby for rest before streaking to her nest.

For several seasons I had been trying to photograph *Megachile brevis* at her work of cutting out petal or leaf fragments. Always, it seemed, the insect avoided the flower upon which I had focused my camera. Then, one morning last August, the bee came to me and fairly begged for her portrait!

I had just taken a picture of a newly opened okra blossom, when I saw a leaf-cutter bee circling about the flower I still had in camera focus. Without moving my stance, I immediately cocked the shutter and waited. Within a half-minute I had my first picture of the bee in action. During the following thirty minutes, while the insect made four round trips to its nest, I made five exposures; three of which later proved to be quite sharp and clear.

The overwintering mature larva, called by Dr. Michener, "prepupa," at the warming of spring, changes into a pupa. Shortly thereafter the adult form emerges into the sunshine. If it is a female, it will promptly begin its nest building; if a male, it will begin a life of comparative ease.

By summer's ending, so rapid is the *Megachile* "turnover," as many as four generations may come into being during the season of flowers. But the bees are more commonly observed as fall comes near, and the floral flood is at its height.

UNIVERSITY OF KANSAS PHOTOGRAPH

Leaf-cutter bee nests in hollow stalks of giant ragweeds. At left four complete cells, arrows pointing to leaf plugs just above the cells. At the right six cells, with the guarding plug of leaves above the uppermost cell.

★

Wave to the Mountain

By DANIEL SMYTHE

Wave to the mountain,
And soon it will wave back
With shoulders full of trees
Beyond the winding track.
It may not know who waves
In green miles from its plot;
But you are part of rhythm
A million years have brought.

The white-fringed orchid carpets wet, spongy meadows and bogs and is the second most common orchid to be found in Newfoundland.

The most common Newfoundland orchid is the dainty arethusa, its pink, elfin flowers being the first to transform bog and meadow.

Newfoundland's Orchids

By EDWIN F. STEFFEK

MANY people think of Newfoundland as a cold, bleak place where little grows. Although it is true that the summers there are short, and apple trees bloom about the fourth of July on Newfoundland's west coast, the weather is agreeable during the summer, temperatures rarely getting above eighty degrees.

However, here is a land of contrasts. The coast is a series of deep, fjord-like bays and bold, rocky headlands that rise up in some places as much as 2000 feet almost straight out of the sea. Yet, the tops of these promontories are, many times, flat and mesa-like. Likewise, Newfoundland is a land of dense forests of spruce and fir, with some yellow birch mixed in, and there are also vast rocky barrens and muskegs that stretch as far as the eye can see. It is a land where flora like that of the New Jersey pine barrens meets flora of the Arctic.

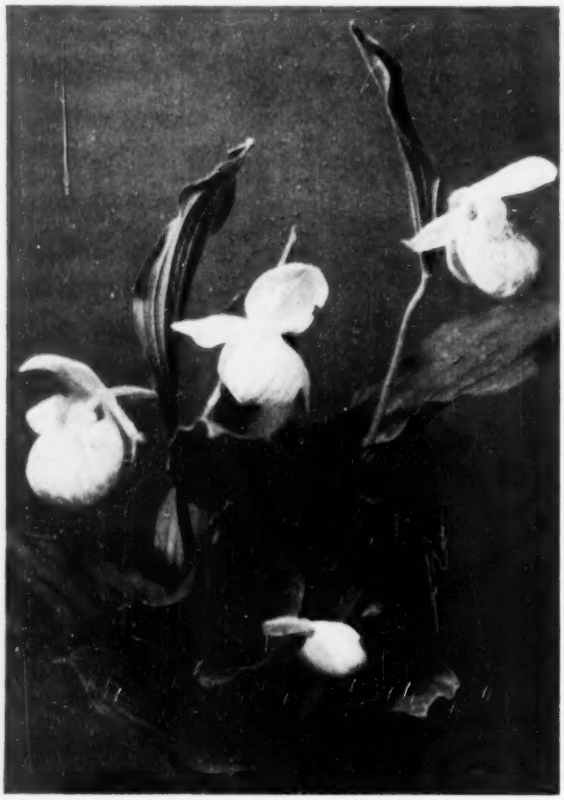
It is on the west coast, particularly in the region at the head of Bay St. George, where most of these varied topographical features come together, and to them is added some comparatively flat agricultural land. However, Newfoundland is extraordinarily well-watered, and peat bogs seem everywhere, including the mountain tops, creating a veritable paradise for many kinds of orchids.

Unquestionably, the most common orchid in this region is the dainty arethusa, *Arethusa bulbosa*, which carpets the bogs with its pink, elfin flowers on graceful six-inch stems. It is one of the first to bloom, transforming the damp meadows and boggy areas into waves of pink. For companions this plant has the rhodora, *Rhododendron canadense*, beloved by many as a harbinger of spring; sheep laurel, which blooms a little later; *Ledum groenlandicum*, the Labrador tea; cranberries; various blueberries; and the ubiquitous pitcher-plant, the provincial flower of Newfoundland. Here in full sun the arethusa seems perfectly happy, sitting on its bed of sphagnum moss and dangling its toes in the water beneath.

Occasionally found with this orchid, but much scarcer, is the birdlike calopogon, *Calopogon pulchellus*, even more dainty than the arethusa, if that is possible. Rising on slender, wiry stems, the flowers wave with an airy grace in every little breeze, making photography a chore. It blooms a little later and along with the last of the arethusas.

Another dainty little bog-dweller, which blooms about the same time, is the rose pogonia, *Pogonia ophioglossoides*, sometimes found in the low bogs near the sea and sometimes in the high ones on the mountain tops. Nowhere is it as plentiful as the arethusa. I well remember trying to photograph it, half-kneeling, half-sitting in the wet sphagnum moss, a tiny rivulet bubbling and gurgling around my shoes while I tried to look into the camera and shield the flowers from the wind, all the while worrying whether the light would hold out long enough for me to get back to camp.

Perhaps, the second most common orchid I found in the vicinity is the white-fringed orchid, *Habenaria blephariglottis*, which blooms there slightly later than those already mentioned. Its blooms come with the sheep laurel, and it carpets the wet, spongy meadows and bogs almost as plentifully as the tiny arethusa. However, this habenaria grows somewhat taller, and, while the flowers are daintily cut, the plant, as a whole, is not as graceful as arethusa.



The showy or painted ladyslipper vies with the yellow ladyslipper and the pink, stemless ladyslipper among the orchids of Newfoundland.

The tall white bog orchid, *Habenaria dilatata*, is one of the several orchids of its genus, at first glance looking like ladies tresses.

Appearing about the same time as its relative is the small purple-fringed orchid, *Habenaria psycodes*, which is found in slightly drier spots. For companions this orchid has *Rosa nitida*, the little northern bog rose, and the delicious Newfoundland wild strawberries, as well as daisies. Likewise, the orchid tolerates a little light shade from a few larches and black spruces nearby. However, the purple-fringed orchid is an agreeable plant anyway, and perhaps the easiest of all the bog orchids to naturalize in the wild garden.

Still another of the bog orchids is the larger *Habenaria psycodes grandiflora*, a truly beautiful form that blooms a little earlier and is larger in every way than *H. psycodes*. Then, too, there are other less attractive habenarias, such as *H. hyperborea* and *H. dilatata*, which at a quick glance look like ladies' tresses.

In the deep woods and in the moist rich mold under the shade of the ever-fragrant balsams live the large-leaved species, such as the round-leaved *H. orbiculata* and the still larger-leaved *H. macrophylla*. Here, in company with a few ferns and bunchberries and twinflowers in the sunny spots, these orchids bloom unnoticed by all except the few insects that do their pollinating.

However, no mention of wild orchids could be complete without the charming ladyslippers. The pink, "stemless" one, *Cypripedium acaule*, of course, is usually found in the drier (Continued on page 332)

Great logs, such as this fallen giant found on a marsh bank, may house raccoons and blacksnakes as well as a wide variety of smaller inhabitants. The teeming life of galleries that penetrate the softening wood is easily revealed with a cutting tool and a hand lens.

A Log of Logs

By WILLIAM HOPKINS AMOS

Photographs by the Author

A GROUP of students stumbled across a marshy clearing. Sliding, sticking, losing shoes and grasping at bushes for support, they welcomed the appearance of a few half-buried logs on which to stand and find relief from the spongy, sucking mud. They looked out over the dismal, gray beauty that belongs only to a woodland marsh after the leaves have fallen.

"Not much here," said one.

"Too late in the year," another added.

Too late for frogs and turtles, late for summer birds and darting mud trout, but activity was near, and closer than they knew. Beneath their feet, within the crumbling substance of the very logs on which they stood, creatures grew and crept, ran and even swam about. It is not often known that rotting logs are favorable habitats sought out by many small plants and animals that require security, sufficiency of water and an abundance of organic food matter. Usually these requirements are satisfied within a decaying log.

A log, observed over a period of years, will show a progression of animal and plant life until the wood has entirely disappeared, and only a richer organic deposit is discernible in the already fertile soil.

Before a tree falls, its outer surfaces are often inhabited by single-celled plants and lichens. Insects of several varieties, both adults and immature forms, may be found in and beneath the bark, providing inroads for moisture and future tenants. Should the tree be living when the fall occurs, the dense sap in the food canals just beneath the bark will attract insects and other animals to its high food value, once the flowing ceases and the bark loosens. The growth layer, cambium, likewise attracts certain forms of life to its more delicate tissues. Such action prepares the way for other insects to attack the heartwood and for the eventual decay of all wood tissues. With breaks in the limbs and trunk, the open vessels running the length of the tree continue to contain a watery sap, but in a stagnant condition. Surrounding cells, no longer provided with food, die. As the various vessels fall into disrepair, water suffuses the tissues, carrying with it bacteria of decay, which feast upon and transform the ingredients of protoplasm. Decomposition advances, and with the creation of new entries throughout the log, more organisms follow to make use of the products of decay.

Countless microscopic animals swarm within the wet tissues as the log degenerates into damp matter. Dozens

Decaying wood is richly organic and favorable for the early growth of seedlings. The young roots may aid in splitting wood tissues, but often fail to penetrate beyond the outermost rotten layers. The root above is groping and turning in an attempt to find entrance into the still-firm heartwood.

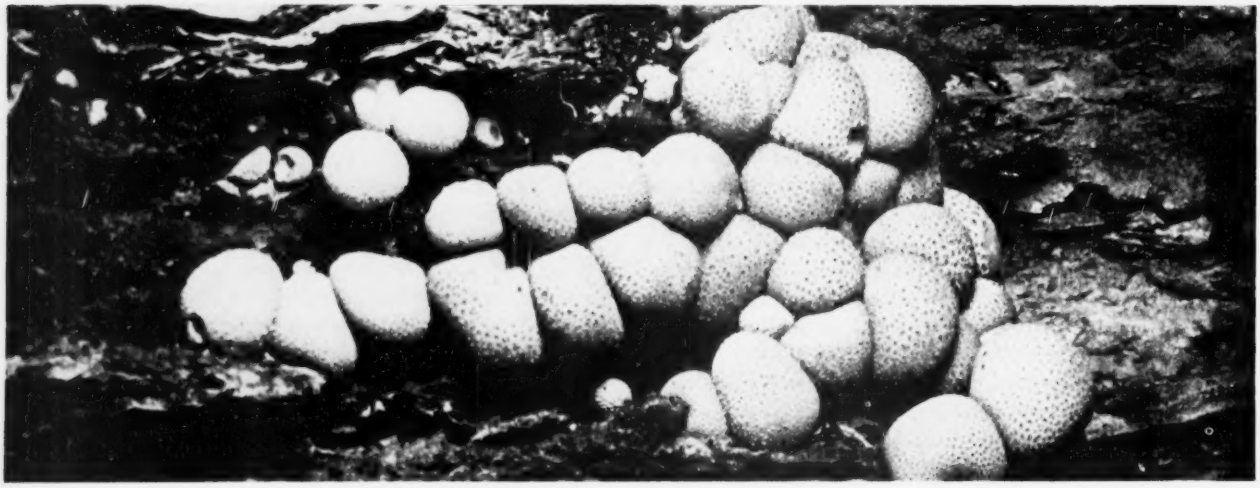
Not all members of the mushroom group are the conventional umbrella shape. Some, as *Clavaria*, above, are so branched and colored as to be known as coral fungi. They are found on fairly new logs and branches, usually before the bark is gone in the process of disintegration.

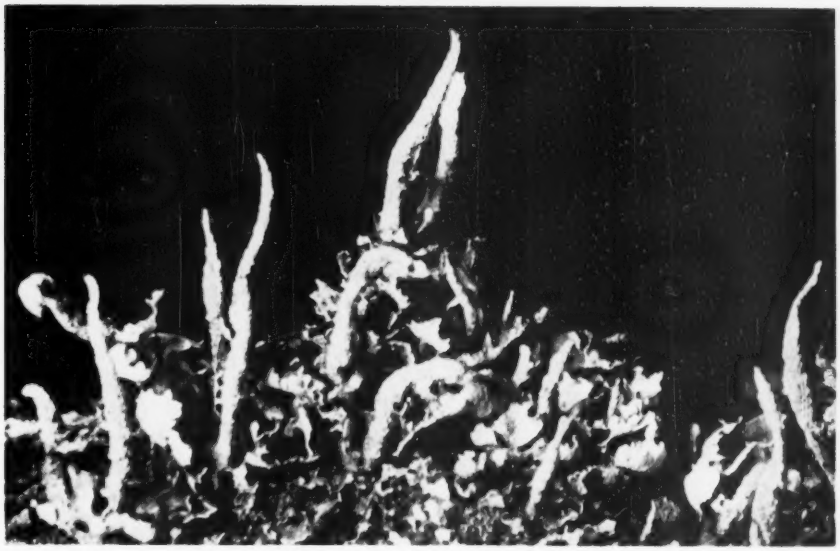
of roundworms and hundreds of single-celled animals may be found in each drop of water squeezed from the pulpy wood and examined under a microscope. To attempt to estimate the total population now supported by the log is hopeless.

The wood falls apart increasingly. Earthworms easily work themselves through, devouring quantities of the humus. Salamanders push their slender bodies into the log, where chambers are excavated in which the female guards her eggs and the log aids a salamander generation.

Little by little the tissues settle, drift apart and turn into marsh mud. A raccoon, seeking grubs and worms, hastens the process by tearing into the mushy substance. The log ceases to exist. The diverse populations it supported at varying stages in its decline have disappeared, seeking other logs in the precise state of decay most suitable to their needs. So the seemingly lifeless logs were actually active in aiding Nature to carry on her endless work.

While some forms of life are peculiar to rotting wood, others accept its presence as just another mass of organic decay. This is true of *Scleroderma*, a puffball common in late summer and fall, and which grows equally well in soil.

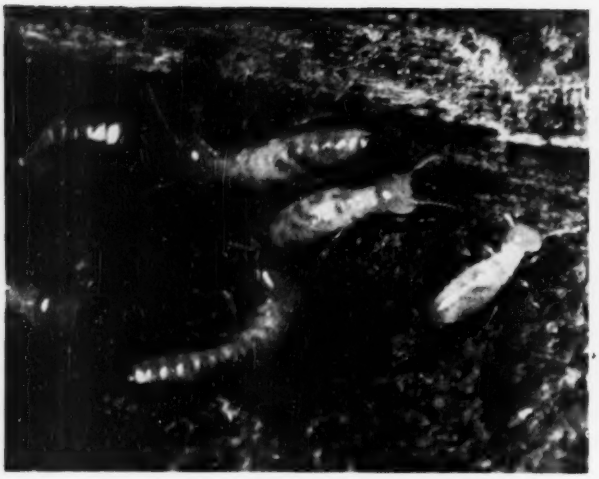




Lichens, such as *Cladonia*, are strange associations of fungi and algae which grow together in distinctive forms for mutual benefit. They may remain on the bark of a log as long as it has substance, and often produce colorful fruiting bodies that rise into the air to insure spore dispersal. Lichens are of world-wide distribution and are found in nearly every terrestrial environment, including polar regions and extremely high altitudes.

Mushrooms, as with most saprophytes, grow in the richest organic decay. They require no direct solar energy for the manufacture of food and exist easily within hidden recesses of the wood. *Mycena*, a small and common mushroom of the fall, often may be found deep within a hollow log. →

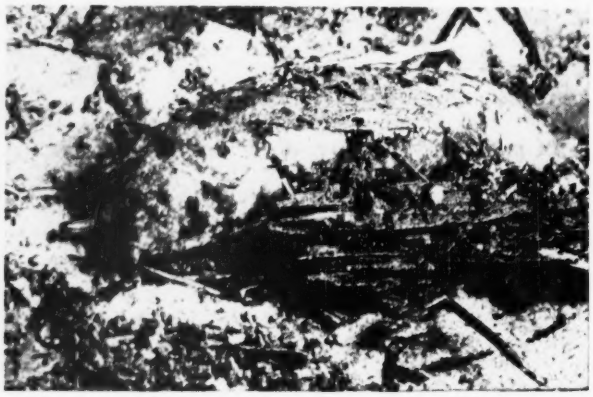
Panus stipticus is a late fall and winter mushroom found on logs and stumps. While not edible, it has unusual properties. If applied to a cut it causes blood vessels to contract, and, as a result, has been used to stop minor bleeding.



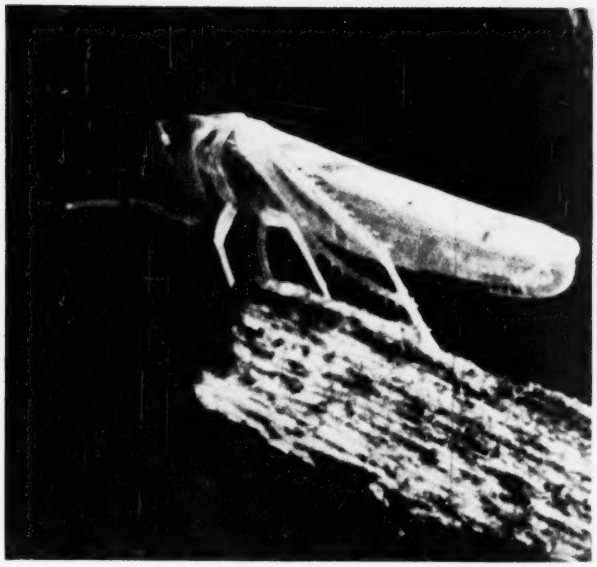
Beset with a hunger for food they cannot digest, termites devour great quantities of wood. Within their digestive tracts one-celled animals live, ready to reduce the cellulose to a simple carbohydrate used by the termite. This partnership cannot be dissolved without the demise of both participants.

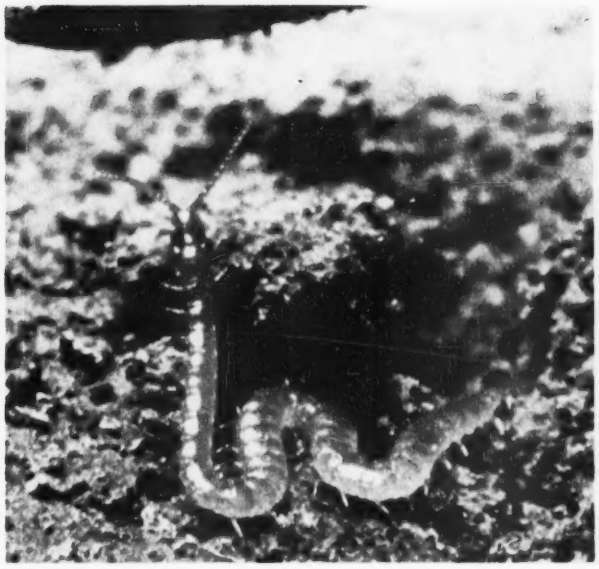
The black carpenter ant, *Camponotus herculeanus pennsylvanicus*, is seldom still long enough to be photographed. While it may complete extensive excavations within the log, it does not eat wood matter as does *Reticulitermes* shown at left.

Passalus cornutus (above), a large wood-boring beetle, may squeak audibly when disturbed. Should the log dry out, air-breathing snails (below) are capable of withdrawing deep in their shells where they successfully estivate until moisture returns.

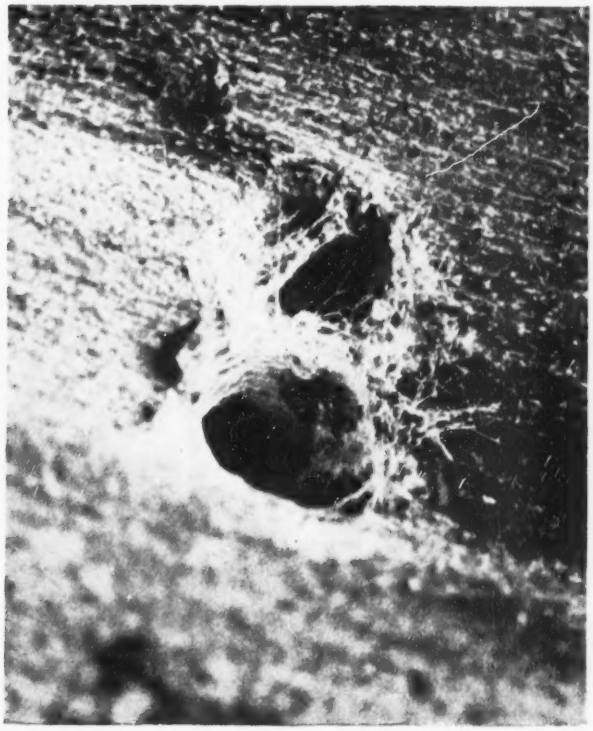


Slugs, as *Philomycus* (above), are easily overlooked due to their drab coloration and the adhering of wood particles to their sticky bodies. The pill bug, *Porcellio scaber* (below), is actually a terrestrial crustacean and differs little from its aquatic relatives.

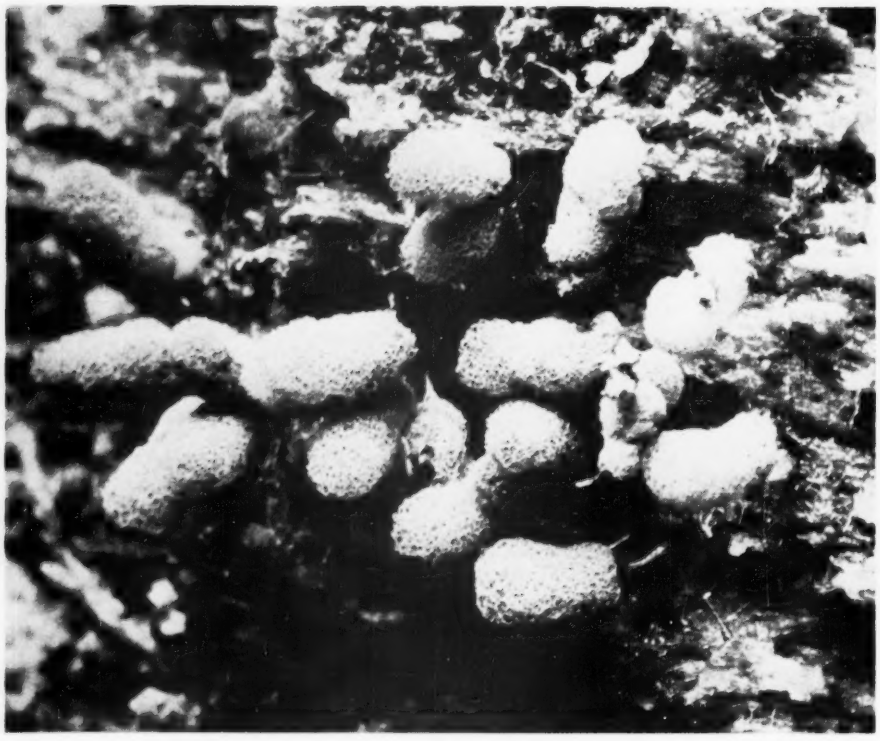




Tiny leaf hoppers (upper left) have been known to hibernate through the winter in old logs. Centipedes, even the minute, blind *Geophilus* (upper right), are fiercely predaceous. The rounded, flexible body of the harmless millipede (right) is admirably suited for all but the smallest tunnels. A fisher spider, *Dolomedes tenebrosus* (lower left), hovers over a crack in which it may capture an unwary victim. Funnel web spiders build their tunnels of webbing (lower right) under bark where they wait for victims to become enmeshed in the strands about the entrance.

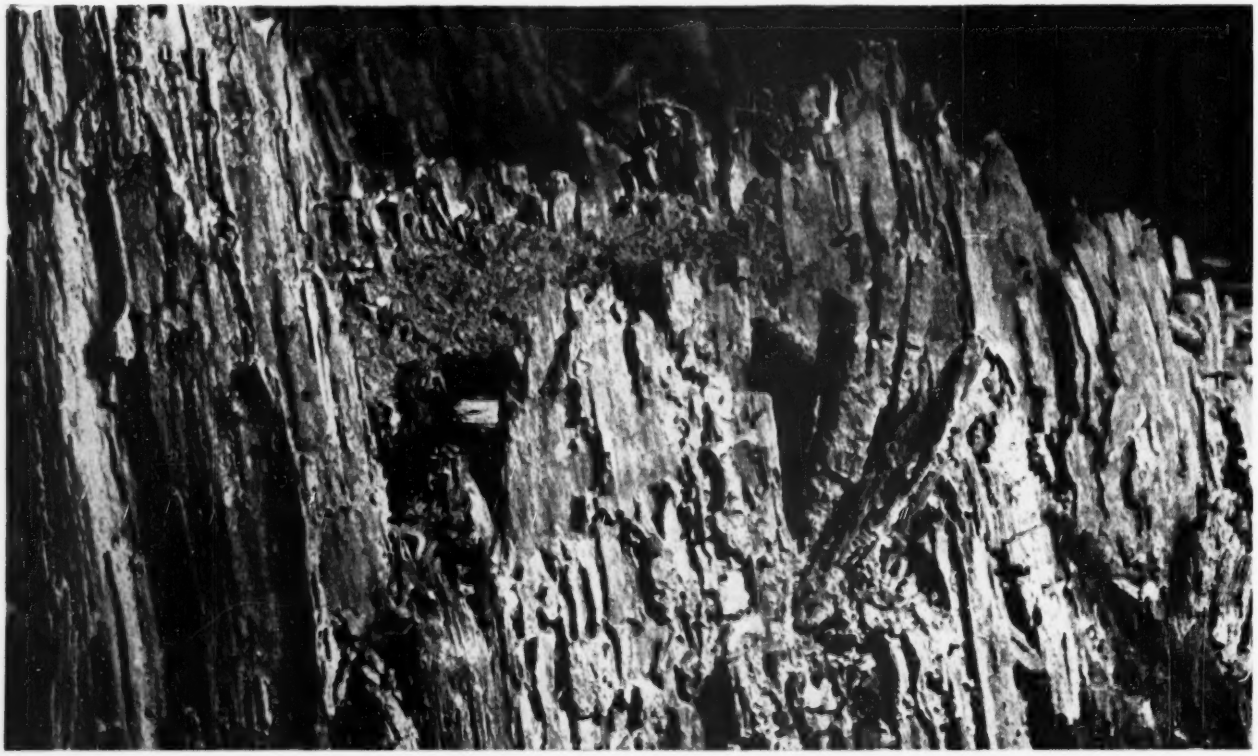


Marchantia, a liverwort and a relative of the mosses, is found occasionally in association with dead logs. The male antheridiophores grown by this specimen will produce sperm to swim through surface moisture to a similar female structure on a nearby plant.



Deep within the rotten log may be a large amoeboid mass, flowing slowly but discernably through the wood tissues and feeding upon organic matter. It will erect complex and colorful fructifications which bear spores. Those of *Arcyria* are rose colored.

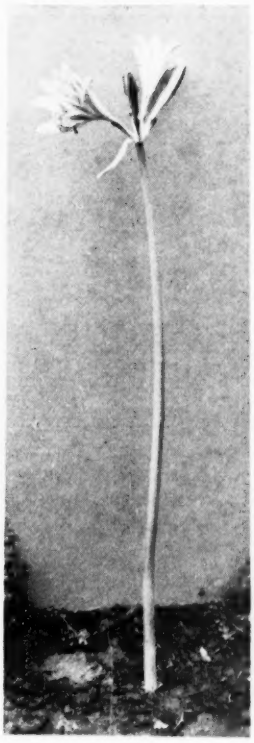
Through the close-up lens, the log is a towering and craggy world, possessed with a beauty of its own.

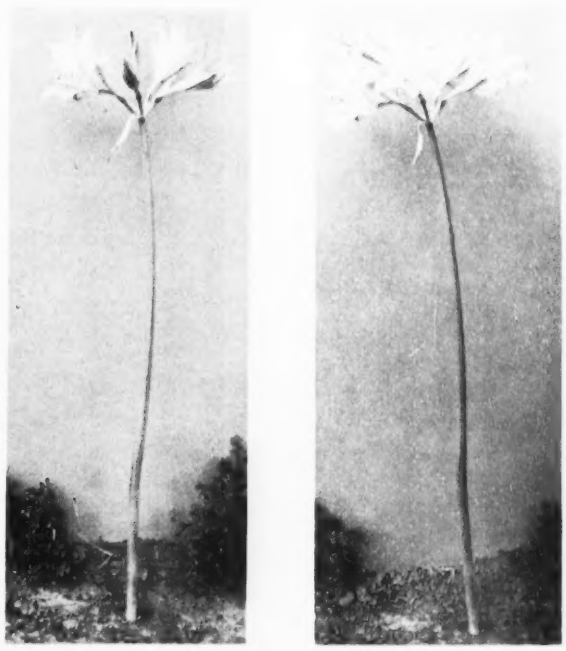


At seven in the morning, August 7, *Lycoris* had reached one and three-quarters inches. . .

. . .August 8, twenty-four hours later, it had pushed up to a height of six inches. . .

. . .then it doubled its height before seven o'clock, August 9, and had reached one foot, below, adding seven more inches by August 10.





By the time it was photographed the morning of August 11, the plant had reached the two-foot mark (left). The next 24 hours found it only three inches higher, and the next only one inch, or a measure of 28 inches growth between August 7 and 13.

Lycoris Has An Explosive Beauty

By R. R. THOMASSON

Photographs by the Author

THERE probably is no other plant with the explosive beauty of *Lycoris*. Its spectacular manner of rushing a flower stalk to a height of twenty-four to thirty inches, and bursting into full bloom all in a week's time, has given to it the descriptive names of Surprise Lily and Magic Lily. Another common name, Resurrection Lily, stems from the plant's habit of becoming dormant without a vestige of top growth for some weeks in mid-summer, and then, in late July or early August, sending up a flower stalk out of the hard, bare ground with such speed that one can almost see it grow. Truly it appears to be a resurrection.

The loveliness of the whorl of six to eight lily-like blossoms heightens the effect of the plant's unusual performance. The individual flower gives us every shade of color to be found in the range between a lavender-purple and the most delicate shell-pink. The bud has the darker color, which softens to the lighter pink as it opens. A cluster of eleven *Lycoris* stalks, all in full bloom and with a total of some sixty-five or seventy blossoms, is indeed a vision of loveliness not soon to be forgotten. Such was my introduction to the plant fifteen years ago. Apparently a single bulb had been planted several years before, and then had been neglected. The delicately tinted blossoms were borne proudly above the surrounding weeds.

Lycoris grows from a dark-colored bulb the size of an overgrown trumpet daffodil bulb. The strap-like foliage, which is somewhat larger than that of the daffodil, appears in the spring along with that of the daffodil, and dies in late June, as the daffodil foliage dies.

Then one day, a month to six weeks later, we see a spear-like flower bud of pale green forcing its way through the hard ground. Neither heat, drought, nor packed soil seem to discourage it. Only the alert gardener may note the green spear peeking through the soil. One who is less alert, or may look only casually at the garden, is amazed, a few days later, to find the flower stalk grown to full height, with all the blossoms open. One is

The individual flowers of *Lycoris* provide a lovely range of color from a lavender-purple to a delicate shell pink. The bud presents the darker color, which softens into the pink as the bloom opens. The explosive character of the growth of this plant has given rise to a number of descriptive names.

apt to wonder where it came from and when it all happened.

Watching the day-to-day growth is both absorbing and surprising. Last summer the measurements I took of one stalk, at approximately twelve hour intervals, were as follows: 2¾", 5½", 8", 11½", 15½", 20", 22½", 25½", 27", 28", 29½", 30". On the sixth day two of the seven buds were open, and on the seventh day five were open. A growth of six to eight inches in twenty-four hours is not uncommon, and I have measured a ten-inch growth in one day.

The botanical name, *Lycoris squamigera*, suggests the Japanese origin of the plant. It was introduced into the United States toward the end of the 19th century. Although it has been with us more than fifty years, it still appears to be little known.

Another common name of *Lycoris* is Naked Lady. The flower stalks, without any foliage whatsoever, do, indeed, appear naked. For this reason many gardeners plant *Lycoris* behind some other perennial that provides foliage in July or early August and serves as a foil for the bare flower stalks. However, planted in a dense group, massed *Lycoris* have their own special beauty.

A group of *Lycoris* plants makes a lovely spot in the garden. However, the naked appearance of the tall stems moves some gardeners to plant perennials beside *Lycoris* to hide this nakedness.

The Ties that Bind

By MARY FRANKLIN

WE HAVE a pair of pre-kindergarten naturalists. They may not be particularly scientific but they make up for their lack of technique by their enthusiasm. Linda is four, Mike three, and Mike took his first "nature hike" in a buggy at one. We started out quite casually to walk along a side road where Linda could roam and explore as she wished. She nibbled sour grass, watched a farmer and his horses plowing his "garden" and saw her first goldfinch. It was such a successful outing that we have repeated it many, many afternoons since.

Linda and Mike, Naturalists

We make no rules or programs of study except to try to answer the many questions the youngsters ask and to connect new discoveries with things already familiar. In the fall we watch the woolly bear caterpillars scurrying across the walk and go back to the house to look at the Arctiidae moth we had collected in the summer, or find and examine the nest of the Baltimore orioles who spent the summer near our house. As we spade the garden we find larvae and pupae we can identify with adult insects, or look with pleasure on the earthworms that are helping us to improve our soil. We watch the bees collecting nectar from violets beside the creek and taste the sweetness ourselves. Linda and Mike include honey on the next grocery list and tell us as they eat how the bees made it for us.

On rainy days, and in the winter, we often sit down with Peterson's *Field Guide to the Birds* or Hammond's *Nature Atlas*. There is an especial thrill in finding outdoors a "new" bird or insect or flower we have met in the picture books. During a recent visit to their grandmother's home, Linda and Mike heard and saw their first mourning doves and watched their first soaring buzzards with a joy like meeting old friends.

Our seasons have identity far beyond mere warmth or cold. In February the first caw of returning crows sends us to the hollow where we find the earliest skunk cabbage flowers. Winter may bluster for weeks to come but we can wait. We are watching the buds grow larger and our own garden is marking spring's arrival. Linda's crocuses yield to Mike's wood hyacinths, and they, in turn, are followed by my daffodils. Then the hills around us brighten with pink of peach trees and the white of flowering dogwood. As the apple blossoms open, Mike and his father take off on a hunting expedition for ambrosial sponge-cap morels, with side trips to look at dog-toothed violets, rue anemones, and bluets.

As the weather warms we find pupal cases on our iris leaves. This is our cue to mix a bait of souring fruit juices and molasses, which Mike and Linda paint on the tree trunks beyond the garden. Bedtime interferes with collecting the moths they have attracted, but Jim and I take over the night work and hold morning inspection on the specimens we have found. The neighborhood boys now bring their choice finds, and Linda and Mike are often able to name the insects brought for identification. This naturally gives them great satisfaction and prestige.

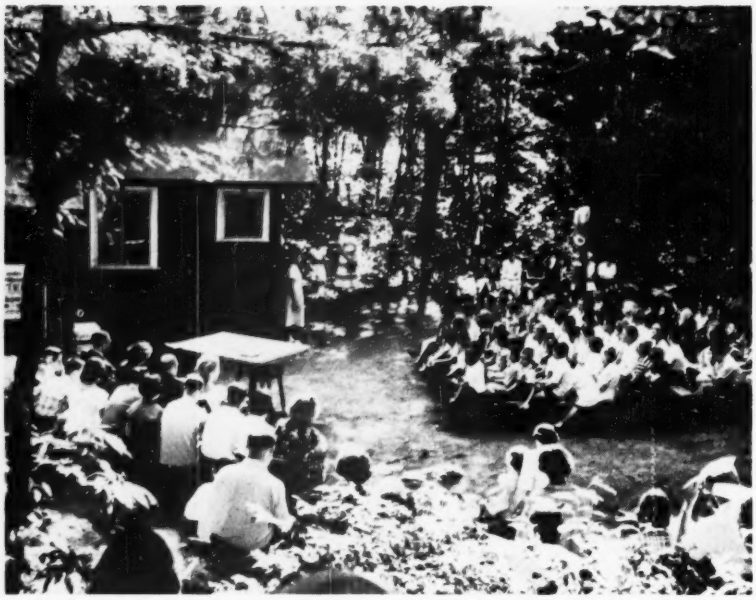
Summer is especially insect season. Some we watch but leave unmolested—ladybird beetles and praying mantis. Some we collect as interesting and attractive creatures—moths, butterflies, locust and elderberry wood borers. Some we engage in constant warfare—Japanese beetles, Mexican bean beetles, tomato worms, squash bugs. Modern insecticides are useful indeed, but Linda and Mike do their bit, too. Armed with empty peanut tins they stalk the garden rows. When we harvest our crops they feel a rightful pride in the role they have played in protecting our vegetables.

Jim and I encourage the (Continued on page 331)

School by the Pond

By ALDEN S. WOOD

Photographs from Worcester Museum of Natural History



One of the graduating classes at the Wendell Phillips Parker Nature Training School receives its certificates in the sylvan setting the youngsters have learned to love. Parents make up the audience.

THE YOUNG man waiting for the "walk" light grinned as he watched a bus filled with laughing youngsters slowly turning a corner at Tatnuck Square in Worcester, Massachusetts.

"Say, Sergeant," he remarked to a nearby policeman, "there's the happiest bunch of kids I've seen in a long time. Where's that bus taking them? The sign on the front said 'Nature Training School'. I thought all the schools were closed for the summer."

"Well, sir," replied the officer, "those kids *are* going to school. They call it the Wendell Phillips Parker Nature Training School. One of my kids goes to it. It's located out in Paxton on Asnebumskit Pond."

"Nature Training School, eh," said the young man, "I guess that's one on me. What do the kids learn out there, the names of different birds and trees and so forth?"

"That's a part of it, yes," answered the officer. "And they teach 'em about conservation of natural resources, and a lot of other things that I don't have time to tell you about. If you're really interested, drop over to the Natural History Museum. It's at 12 State Street. Mr. Potter's the director, and the feller who founded the school. You'll be surprised. Better catch that light, mister."

This little vignette serves to illustrate the popularity of an interesting and even unique school, the Wendell Phillips Parker Nature Training School. Children between the ages of eight and fourteen, whose parents may be industrialists or policemen, lawyers or laborers, may attend the summer sessions in Nature instruction at the outdoor classrooms in Paxton. A branch of the Worcester Museum of Natural History, this school was founded in 1940 by Richard C. Potter, present Director of the Museum, who devoted all of his time to these two institutions.

Mr. Potter, an energetic man in the prime of life, has dedicated his life to teaching and Nature study. He attended the University of Chicago and Massachusetts State College, graduating from the latter with a Bachelor of Science degree. After leaving school, he became a forester, and the wealth of knowledge he accumulated during the years he spent at this profession was of invaluable assistance when he was appointed to his position at the Museum.

One of his first projects was to start the actual creation of the Nature Training School, for years his secret ambition. Reaching into his own pocket for funds, and employing his inherent Yankee ingenuity, he went to work. A year's experimentation with various courses convinced Mr. Potter that his plan would work. Setting aside a part of his farm in Auburn for study, he built a cabin for what indoor work would be required, and hired Robert Cossaboom, a senior from local Clark University, as the first paid director of the school.

Wendell Phillips Parker was a professor of mathematics at Worcester South High School for many years. His love for the outdoors and working with young people brought him into the Worcester Natural History Society for which he served as Treasurer for 19 years. Mr. Parker founded the first Trail School for children in 1924. To honor this long and helpful association with the Society, Mr. Potter chose the name of Wendell Phillips Parker to identify the Nature Training School.

The opening class was attended by ten adults, 28 children, and a rain storm, but emerged a comparative success under the conditions. The end of the first season showed a heartening increase in interest and attendance.

Since this unpretentious beginning, the museum head and his associates have put in hundreds of hours of overtime, elevating the school to its present position

Youngsters examine some insects with a magnifying glass, expressing relief that the specimens really are not that large.

of respect in the community. Their faith in human curiosity about natural surroundings has also been rewarded by the wide interest that Worcesterites have taken in the School.

In 1946, a generous donation of forty acres of land made it possible for the school to move to more suitable grounds in the town of Paxton. This contribution, in itself an indication of the worthiness of Nature training, was made by Mrs. Frank C. Smith Jr., and her brother, Chester E. Williams, both Worcester folks. The land given was and still is a paradise for Nature lovers. Located on Asnebumskit Pond, where varied types of fresh-water life and vegetation can be observed, the tract provides woods, pasture land, brooks and swamps. There are several outcroppings of rock that display the famous Worcester phyllite, occasional garnets and other minerals. Undisturbed by the hand of man for many years, the primitive beauty of this area provides a perfect atmosphere.

With the erection of new buildings, and the purchase of additional scientific equipment, the school was prepared for opening.

The Museum's Educational Committee had organized a progressive Nature training program and appointed a permanent teaching staff. Miss Anna M. O'Connor was named the school's Executive Director, and eleven other qualified people were employed as counselors, lecturers and teachers. Formulation of curricula was not a simple task, but it was finally decided that the age of the student, his knowledge of Nature study and his general intelligence would be the prime factors considered when a child enrolled in one of the courses. The program is graded skillfully. Beginners are placed in Group "A," which is a sort of basic training, for the first summer. During the following two summers, the youngsters do more advanced work in Groups "B" and "C," and those who are interested in becoming counselors may continue on in Group "D," a special eight-week course. Students who have exhibited unusual teaching ability are allowed to enter Group "P.C." (Provisional Counselors) from which some may be chosen as counselors or, possibly, teachers. The Board of Trustees of the Museum presents an engraved certificate to the child who completes the course in any group.

A class day at the school opens with all joining in a non-denominational Nature prayer, which is followed by the flag-raising ceremony, the pledge of allegiance and the National Anthem. At ten o'clock, morning class assignments are read, and the pupils, accompanied by their instructors, begin their day's work. Each morning class includes such subjects as flowers, land and water animals, insects, flowerless plants, or birds. There are also periods for the study of trees, climate, topography, rocks and minerals. Depending on the subject to be observed, the students meet either in Potter Lodge or in the outdoor "classrooms," where logs are seats and the blackboards stretch to the horizon.

At noon, the children return to the Lodge to enjoy their lunches and the free milk that the school supplies daily. The bell that calls them in is more than just a dinner bell. It is the only

Some of the geology enthusiasts examine a specimen of the famous Oakdale quartzite.

surviving part of a locomotive that was wrecked in Maine. It was presented to the school by an official of the Boston & Maine Railroad. Following the noon meal, the youngsters join in supervised recreation before returning to their classes.

Promptly at one, the afternoon sessions begin. While the morning includes only required subjects, the afternoon is devoted to courses that the students choose themselves. These electives are varied and cover such subjects as handicrafts, surveying, tree labeling, grasses, tree surgery, astronomy, terrariums, trail-blazing, or identification of edible plants. Notebooks are supplied by the school without charge for those students who wish to use them.

The youngsters are encouraged to participate in class work by giving talks on their favorite subjects, and this custom has, on occasion, provided some humorous sidelights. Counselor Ann Grant recalls the day she asked a ten-year-old if he would like to give a lecture on snakes, his chief interest at the time. He agreed, and when the group assembled that afternoon, went promptly to the head of the class. Ann was a bit disappointed when she saw that the boy had not brought any specimens to illustrate his talk, but her disappointment was not for long as the speaker casually proceeded to remove no less than five different snakes, one more than two feet long, from his pockets!

The bell sounds for the last time at three o'clock, and everyone assembles for the flag-lowering ceremony, and the playing of "taps." Forty-five minutes later, the children are aboard buses on their way home, still under the watchful eyes of a counselor.

Mr. Potter is much pleased with the present school, but he remains still a man with an eye to the future. New courses are constantly being considered, such as the study of erosion, bee-keeping and feeding habits of domestic animals as examples of variety. The one task that Mr. Potter finds unpleasant is that of turning prospective students away. Last year, for example, enrollment in each of the two four-week semesters easily could have topped the maximum allowance of 100, but the Educational Committee has ruled that personal attention is far more important in the school than a large student body. Some parents are enrolling their children a season in advance to assure their being accomodated.

It is gratifying to the members of the faculty and their students to see the widespread interest that their institution has created. Parents of students, local and state dignitaries, and even visitors from foreign countries have come to see the school and discuss it with its founders. During such a tour, visitors are informed of the latest project of the Museum, which is a school of forestry recently established at Rutland.

Especially interesting is the financial success that the school has realized. It is, of course, a non-profit organization and entirely dependent upon itself. Yet, in the fourteen years of its existence, there has never once been a deficit. The $30 per-term tuition paid by each student is carefully allocated to cover maintenance, salary and equipment. It has always been sufficient.

A youth who has graduated from the school, says Mr. Potter, has gained more than the knowledge of how to treat a snakebite, or tell a shagbark hickory from a jackpine. There is a more subtle personal accomplishment, perhaps made while staring into the ever-changing heart of a camp fire, or when holding an injured bird. As Mr. Potter puts it, speaking with the wisdom gathered before 1000 camp fires, "An acquaintanceship with Nature, such as they will get in a school of this kind, they can get in no other place."

★

June Twilight

By MARION C. ELLENWOOD

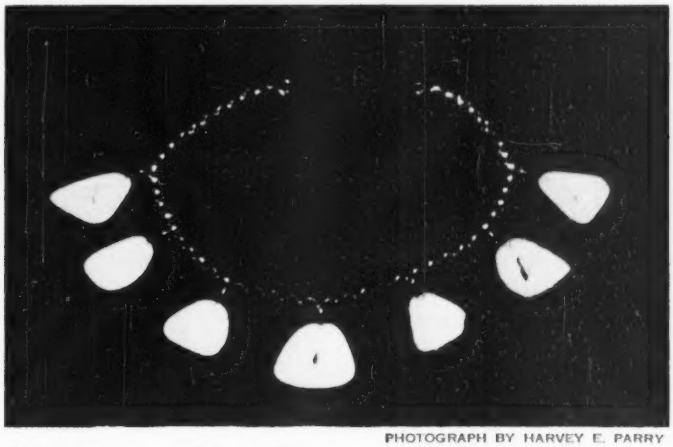
This is evening—and the twilight falls,
a holy thing, across the skirts of day.
The birds still twitter, but gentler now their calls
inside the hedge where last week nestlings lay.
The spruce spread out in peace their blue-green hands
to bless the pool and all green grass of June.
Amazing now how still the white birch stands
while evening falls; not risen yet the moon.

The hermit thrush's wheel of music turns.
The thrashers' family of red and brown
are gathered close for one more night. There yearns
above an anxious parent on the topmost crown
of brushpile. Yes, evening falls, and rest
comes down with night. The velvet dark is blest.

Tagua, from nut to button. First is the vegetable ivory nut, then the button slab, cut lengthwise from the nut. Then comes the partially turned button blank; the button blank; the blank after drilling the holes, and, finally, the dyed and embossed button.

Tagua—The Button Nut

By ELSIE A. PARRY



PHOTOGRAPH BY HARVEY E. PARRY

The author's necklace of tagua made by her husband. The seed has been sliced crosswise, and the interior hole is visible. The rough outer coating of the seed has not been removed.

"WHAT on earth is that around your neck?" I touch a finger to my necklace. "Why, that's tagua." "Tagua. . ! What in the world. . . . ?" "It's vegetable ivory." "Vegetable ivory! But what. . . . ?"

About this time I usually take pity on the baffled inquirer and set him straight on the whys and wherefores of this curious seed of a South American palm.

The chances are good that the inquirer is also wearing some vegetable ivory, without knowing it. Until plastics began to take over the button market in earnest after World War II, buttons made of tagua were counted in millions of gross. The 1943 production, for instance, if laid end to end, would have extended more than 9500 miles in a straight line!

The botanists have had their troubles with this more than "reasonable facsimile" of animal ivory. Whenever Nature gets bored with her assembly line arrangements and introduces titillating variations into the scheme of things, the scientific gentlemen are apt to find themselves at odds. How should they classify this peculiar tree, and its peculiar seeds? Tagua has appeared on occasion among the *Cyclantheae*, the *Pandanaceae*, and the *Aroideae*, and has even been described, ignominiously enough, as an "anomalous genus." As late as 1909 a visitor to Ecuador who called the tagua a "palm-fern" was told curtly by a local botanist: "Don't be ridiculous. Ferns do not flower but have spores!" But now, after years of jockeying for place, *Phytelephas macrocarpa* seems to have come to rest, botanically, among the true palms, *Palmaceae*.

Of course, *Phytelephas* is known locally (from the Isthmus of Panama through Colombia and Ecuador to the northern half of Peru) by other, less scientific names. The conquering Spaniards called it *Palma de Marfil*, ivory palm; the natives gave it several names, depending on their tribal origin and their language—*tagua*, *cade* or *cadi*, *ante*, *pullipunta*, *homero*, *coroso*, *mococha*. The word *tagua* seems to be reserved for the ivory "nut" itself, the seed of *Phytelephas*. *Cade* or *cadi* is generally used for the thatch made from the leaves of the palm, and this brings up a curious point. These two words are the equivalent of *kata*, which means "roof" in Quechua, evidence once again how widely both plant and place names in that roving language got around in South America, despite the difficult terrain and apparent scanty means of communication.

The inquisitive layman, meeting *Phytelephas* for the first time, is likely to dub it a palm off-hand, or certainly a kissing cousin of the *Palmaceae*. He will miss the tall, swaying trunk that he associates with the coconut palm, the Royal, and the Washingtonian, for *Phytelephas* is short and stocky. However, one will be suitably impressed by the magnificent crown of palm-like, pinnate leaves. Resembling gigantic

ostrich feathers, the plumes thrust themselves upward some eighteen to twenty feet from the low trunk. Bunched beneath them are six to eight fruits, each weighing from twenty to twenty-five pounds.

A fruit is made up of six to eight drupes, each of which contains six to nine bony seeds. All of this is encased in a fibrous, wart-covered wall called the perisperm. This bears some resemblance to hard, brown peat; the bone-hard, durable endosperm is further protected by a thin strong covering. The endosperm is the tagua "nut," the vegetable ivory of commerce, one of Nature's many valuable gifts to man.

The seed of *Phytelephas* does not begin life in this case-hardened fashion! When young, it contains a clear, insipid fluid that can double as water for the very thirsty. Later the fluid becomes milky and sweet, at which stage small animals and some humans find it palatable. In 1845 the botanist Purdie reported: "Enclosing the seeds is a yellow, sweet, oily pulp which is collected at the proper season and sold for one *real* a pound under the name of *Pipa de Tagua;* a spoonful of it with a little sugar and water makes the celebrated *Chicha de Tagua*, said to be the most delicious beverage of New Granada. It has, however, a drastic property." This, unquestionably, is the second stage into which the tagua seed enters before the albumen becomes solid. The thoroughly hardened seed or "nut" has this interesting characteristic—it will soften when soaked in water and harden again when set to dry.

PAN-AMERICAN UNION PHOTOGRAPH

The tagua bur before it has been opened by man or Nature. It contains six to eight drupes, each containing from six to nine bony seeds.

Phytelephas is double-sexed. The male tree bears no fruit and carries its heavy cluster of majestic leaves almost erect, seemingly taller than the female. The leaves of the latter have more horizontal spread, and at their base the flowers grow out from the trunk. These perfume the surrounding air with a penetrating odor of almonds.

The trunk of *Phytelephas*, like that of the banana, is composed of closely packed, fleshy leaf-stems. Its stocky proportions are admirably engineered for the job of holding aloft not only the crown of immense leaves but also the heavy clusters of bur-like fruits.

Few trees are more pleasantly cooperative than *Phytelephas*. In about ten years, with no human assistance, it reaches the nut-bearing stage and then proceeds to live from fifty to one hundred years, producing fruit continuously. When the fruit is fully ripe—from flower to fruit takes roughly one year—the enclosing bur bursts, letting the nuts fall to the ground for easy picking. Practically every part of the tree can be put to human use. Water in which the roots are boiled makes a medicinal drink with diuretic properties. The solid stem is split and used for flooring. The embryonic leaves, "*quagra-changa*," are used raw in salads or cooked in curry. The mature leaves, deribbed and allowed to ferment from 8-15 days, provide a thatch more durable than zinc. The long, fibrous spathes, with the inflorescence removed, make excellent brooms, and the fibres are used for rope and cord. Finally, of course, the seeds of *Phytelephas* are the vegetable ivory of commerce, until 1946 fifth among the exports of Ecuador

But not all is sweetness and light. This palm is largely a "savage" tree, clannish by nature. Indeed, many natives believe that it will not bear fruit if planted by man! It grows wild in enormous numbers in a habitat of its own choosing, flourishing from sea-level to about 1800 feet, with a preference for the area between 600 and 1500 feet and for a temperature from 22-28 degrees C. It likes sand-clay but will thrive in clay-rocky ground, not despising alluvial and humus earth. Notably tolerant of shade, it takes kindly to the darkest and dampest forests, but it can make do in the open if the moisture is sufficient. But—and this "but" is a big one—*Phytelephas* is found mostly in sections remote from habitation and difficult of access. Between parent tree and the hold of an outgoing ship in the harbor of Guayaquil there lies a long and arduous journey.

In Ecuador (principal exporter of tagua) native laborers, called *tagueros*, usually of Indian or mixed Indian-Spanish blood, are the nut-gatherers. In the truest sense of the word, vegetable ivory is "hand-picked." Neither vehicle roads nor railroads reach into Ecuador's tropical hinterland, much of it only partially explored, where the trees grow in lush splendor. This is a job calling for strong legs and callused feet, for mules used to heavy burdens, for hand-hewn balsa rafts on swift rivers flowing to the sea, for the indispensable machete. The lot of the *taguero* is a hard one, made no easier by the omnipresent malaria

and a choice assortment of other tropical ailments.

The *taguero* gathers fallen nuts and cuts down mature burs, hacking them open to release the seeds. These are the *tagua negra* of commerce, a choice grade. However, in the heyday of vegetable ivory demand, the gatherers, avid for *sucres* and too impatient to wait for the natural ripening process, often cut down unripe burs. These were buried to hasten maturation and later beaten to remove the nuts, known to the trade as *tagua rosia*, or blond tagua.

Wherever the geographical situation makes water transportation feasible, the *tagueros* raft their bags or baskets of nuts to coastal trading centers. Whole families or groups of families join in the venture, going down river on their balsa rafts, some of which take up to fifteen tons of nuts. At journey's end the raft is sold and then comes the long, weary trip home. It is not an easy life, and not especially profitable, either. But it does produce a little ready money in an otherwise slim economy. A curious feature about tagua collecting is its "side-issue" aspect. More often than not nutting is carried on only when work is seasonally slack in other fields. The convenient ever-bearing nature of *Phytelephas* makes this fill-in arrangement possible.

PAN-AMERICAN UNION PHOTOGRAPH

The tagua palm, known to botanists, after some argument, as *Phytelephas macrocarpa*. This tree is bearing the large nuts.

The largely unsupervised system of nutting has invited careless exploitation. Do the nuts happen to hang too high? Well, cut down the trees; there are plenty more! Too many immature carpels slashed from one tree? It does not matter. . . . Too many trees destroyed by fire in thoughtless forest "clearings?" That does not matter, either. . . The tale has a familiar ring, alas.

One hundred years ago a tagua nut was still a botanical curiosity. In a letter (1845) to the botanist Sir William Hooker, the botanist Purdie wrote: "A few days ago thirty tons of the 'nuts' arrived commissioned for the U.S. of America and Germany." They could be bought in London toy shops for a few pence each and were among the oddities exhibited at the Great Industrial Fair in Hyde Park. In 1854 a thousand nuts sold in London for 7 s 6 d, less than two dollars.

But in 1859 an Englishman, A. W. Critchlow, of Leeds, Massachusetts, took tagua nuts out of the curiosity class. He made the first buttons of vegetable ivory. A year later in Schmolen, Germany, Herman Donath added tagua nut buttons to his line of umbrella handles. Now it no longer mattered that animal ivory was growing scarce and that bone was relatively expensive; button manufacturers had found a first-rate substitute for both. Vegetable ivory, in short, "had everything." To quote an enthusiastic advertisement of the 'Forties: "It is unaffected by dry cleaning and pressing; its smooth thread holes do not cut thread on wearing; it dyes any color, including multicolor effects; it embosses sharply and permanently in any design; it withstands all shop operations." And, seemingly, the supply of tagua nuts was endless

Button manufacturers ran into little difficulty with their new material. The nuts, seasoned (dried artificially) and with the outer shell removed, were divided as to size and also for flats and rounds. Then they were sliced by means of a circular saw, not crosswise, but lengthwise to avoid the natural hole (larger or smaller) to be found in each nut. Next the slices were assorted for size before being kiln-dried for 8 to 10 days. The evaporation of all moisture turned the natural bluish tinge to pure ivory white or cream color. After being mixed with waste for cleaning, the slices were turned on lathes into perfect button blanks of assorted sizes. These were smoothed with a mixture of turnings, sawdust, and pumice, drilled for thread holes, and polished again. And, last, came dyeing and embossing to fill the fashion needs of the garment makers.

This industrial process, (Continued on page 330)

George Newbold Lawrence

By W. L. McATEE

ALMOST from the beginning of his ornithological career, George Newbold Lawrence knew what he wanted to do, and he kept on that course the remainder of his long life. He saw the need of work on birds south of the United States and they became, and continued to be, his favorite subjects, particularly those of Mexico, Central America, and the West Indies. The sixth of his papers, in order of the date of publication (1849), described a new species of mockingbird from Venezuela; all but 28 of his 121 ornithological writings related to the regions mentioned; and all but 17 of the 323 new forms he proposed were collected there.

The specimens he worked on were mostly gathered by other collectors, some independent, and some employed by himself or by the Smithsonian Institution. He did little exploring and that he was of sedentary tastes is shown by his living in one city—New York—all his life. Born there October 20, 1806, he was interested in birds from early childhood. His father's estate, "Forest Hill," not far from where the American Museum of Natural History now stands, was a good place for bird study, being near a great migration flyway, the Hudson River. The Audubon family lived nearby and Lawrence became intimate with the sons, Victor and John, but saw little of their father, who was then in failing health. The great impetus to taking up the study of birds in serious fashion came from his meeting Spencer F. Baird in 1841. Although younger by seventeen years, Baird, then as always, demonstrated the gift of kindling enthusiasm for natural history. The friendship then begun lasted throughout their period of coexistence and led to the collaboration by Lawrence in one of the great works of Baird, the volume on "Birds" in the Pacific Railroad Reports, published in 1858. His share in that undertaking was an 80-page account of the water birds of North America.

Lawrence's father was in the drug business, which the son entered at sixteen years of age. At twenty, he became a partner and at twenty-nine, head of the firm, which under him specialized in importing and jobbing. He was a successful business man and was able to retire at the age of fifty-six and devote himself chiefly to ornithology. Eighty-eight of his 121 bird papers were published in his retirement period; his total publishing span covered 47 years.

His almost daily collecting excursions near home from 1820 to 1850 well fitted him for preparing the *Catalogue of Birds Observed in New York, Long, and Staten Islands and the Adjacent Parts of New Jersey*, which was published in 1866; it embraced 327 species. Aside from

George Newbold Lawrence, 1806-1895.

the water bird paper mentioned, this was his most important report on birds of the United States. Leading among those devoted to southern avifaunas were: *A Catalogue of the Birds Found in Costa Rica* (1868, 511 species); *The Birds of Western and Northwestern Mexico* (1874, 316 species); and *The Birds of Southwestern Mexico* (1876, 321 species). He systematically reported on birds of many of the West Indian Islands and edited two important works by other authors: the natural history of the Tres Marias and Socorro Islands by Andrew J. Grayson (published 1872); and an account of the birds of Grenada by John Grant Wells (1887).

The quality of Lawrence's work was recognized by his election to numerous American and foreign scientific societies. He was especially identified with the New York Lyceum of Natural History, which published many of his papers. This organization was merged into the New York Academy of Science, of which he became, in turn, Member, Fellow, and Patron. He was a Founder and an Honorary Fellow of the American Ornithologists' Union and one of the Founders, also, of the New York College of Pharmacy. One genus and twenty species of birds were named for him. His collection of about 8000 bird skins, including some 300 types, was sold to the American Musuem. He died in 1895 at the age of 89, surviving his wife by only five days.

Daniel Giraud Elliot, co-Founder of the Union, described him as, "courteous, gentle, and modest, simple in his tastes, withal a gentleman of the old school."

Root Beer, All-American Drink

By ROBERT C. BAUR

Illustrations by William H. Bodge

REMEMBER when everyone made their own root beer? Dog days seemed less humid when there were cold bottles of root beer in the icebox. Root beer time meant vacation days, and the old fashioned blend of roots and bark is the essence of summer, tasting of Fourth of July picnics and shady swimming holes. The first batch was always ready for Decoration Day, and there was one on hand until ice came to the bird bath.

Making root beer was a pleasant job for a warm afternoon. The grownups did the mixing, but washing the bottles was our contribution to the project. There were no objections to this chore, for a tub was filled under the apple tree, where we could splash as much as we liked.

Later, we helped fill the bottles, and laid them on their sides in the warm grass, near the back porch. It took two or three days for the beads of effervescence to form, but these passed more slowly than school on Monday mornings. Long before that, we drank the contents of the extract bottle, which was filled each time for sampling. There was only a swallow, but the bottle was never too small to hold the leavings of the batch. It was sweet and yeasty, but satisfying, at least for the time being.

Properly aged, the bottles were carefully carried into the cellar, our reward being the privilege of opening the first. The prize was placed under the pump spout and quickly cooled While root beer had a sameness about it, each vintage seemed better than the last, reflecting increased skill by the brewers.

Cellars have seldom sheltered richer treasure than root beer. The chalk caverns of Rheims are no more intriguing than a Yankee homestead with root beer beneath its floors. I can see the bottles yet, brown as brook water against the stone foundation, and I can almost smell the cool earthy dampness of the dirt floor.

A batch of root beer rarely lasted long enough to gather dust, but each year, it seemed, a lone bottle survived our thirsty appetites. Mysteriously appearing behind the potato bin, this unexpected treat sent our thoughts racing across the snow-bound fields to spring.

Root beer probably originated as herb teas that the settlers brewed from the red man's pharmacopoeia of cures and tonics. Non-toxic native plants that have not flavored a teapot at one time or another are rare indeed. Undoubtedly, many of these experiments were prompted by George III. The extent of our forefathers' tea drinking is illustrated by the common terminology of our wild flowers.

Even the lofty black spruce yielded its tenderest tips to quench pioneer thirst. Thoreau praised spruce beer as "a lumberer's drink, which would acclimate and naturalize a man at once, which would make him see green, and, if he slept, to dream that he heard the wind sough among the pines." This naturalist was less enthusiastic about cedar tea, which was too medicinal for his palate. Sampling native teas brewed by his Penobscot guide on a canoe trip up the Allegash in 1857, Thoreau said they could have had a new kind of tea every night.

Individually, many of these teas were medicinal tasting and required blending for extensive consumption. Apparently tea was intended to be medicinal, for in earlier days even the oriental product was dispensed in apothecary shops.

Explorers and missionaries tell of Indians extending hospitality with beverages of maple sap. Aromatic roots and leaves were boiled with this maple tonic, which was believed to have curative powers.

Maple sap, just as it drips from the spile, forms the basis for a drink that has delighted several generations of New Englanders. Stimulated by molasses, hops and yeast, this hardy drink met with the disapproval of the Reverend Nathan Perkins. Touring Vermont in 1789, he was shocked by the quantity of maple cider consumed by the inhabitants. Thomas Jefferson, in a letter to George Washington, rejoiced that the manufacture of maple spirits was less profitable than sugar.

In Hoosier territory, where the sassafras and sugar

maple grow side by side, the combination of maple sap, yeast and sassafras root will long remain a pleasant memory.

Throughout its Appalachian range, where it is known by a variety of names, the black birch was tapped along with the maples for its sweet, aromatic sap. Somewhere we have learned that the manufacture of wintergreen oil is accomplished by using the entire thickly branched summits of the black birch. Since only the flavor is sought this method would seem to be justified. Sassafras, outstanding among the tonic trees, flavored a southern drink, derived from greenbrier roots and molasses.

Other light drinks were made of pumpkins, persimmons, corn-stalks, juniper berries and hickory nuts. The ingenuity of those pioneers, who turned necessity into plenty, is recalled by an old song.

"Oh, we can make liquor
to sweeten our lips,
Of pumpkins, of parsnips,
of walnut-tree chips."

Taverns along the stage routes are remembered for the milder beverages they sold. "Small drink," draughts of roots and herbs flavored with sassafras, spruce or birch, refreshed many a traveler before taking up the bumpy road again.

In a land of clear brooks and sweet water, the settlers also quenched their thirst with beverages flavored with the aromatic plenty of the forest. There was a drink to suit every taste, but the most delightful by far, was the blend of roots, bark and herbs we know as root beer.

Black birch, wintergreen, sassafras, and sarsaparilla were basic root beer flavors. The bark and roots of wild cherry, pipsissewa, sweet flag and spikenard also contributed to the drink. Some recipes called for hemlock tips, spice-wood bark and licorice, dandelion, and roots of dock.

One housewife meticulously recorded the following process on the back of an old note-book: Pour boiling water on 2-½ ounces ground sassafras root, 2 ounces spice-wood bark, 2-½ ounces wintergreen leaves, 1 ounce wild cherry bark, ½ ounce hops and a handful of coriander seed. Two gallons of molasses and a pint of yeast were added and the mixture allowed to stand for one day. Then, the liquid was strained and water added to make 15 gallons.

Beet tops, molasses, honey or maple sap provided sweetening. Yeast put life into the beverage and gave it its effervescent charm. The yeast pitcher was once a permanent fixture in every farm kitchen. This ready-made leaven traced its mysterious power to potatoes, hops, flour and even apples or peach leaves. Natural fermentation was sometimes provided by throwing in a handful of shelled corn.

Some thought an ounce or two of hops improved the flavor. In the absence of hops, bayberry leaves, or winged seeds of the wafer ash served as substitutes. An egg-white, beaten into the batch, increased the foam.

Allspice, coriander seed and Jamaica ginger were substances that gave root beer recipes their individuality. Although ingredients varied, it was the opinion in most kitchens that the best root beer was mixed in warm weather, preferably the evening before bottling.

In colonial days, a glass bottle was rare enough to bequeath to a favorite descendant. Consequently, early root beer makers stored the liquid in crocks or jugs of earthenware. The later abundance of glass saw such containers widely used for bottling homemade beverages.

Use of bottles promoted the popularity of the bottle capper, which became a standard piece of equipment in every home. To the very young, this mechanical gadget was an interesting plaything, which often as not resulted in pinched fingers for the unwary.

Reviving the root beer custom after a fifteen-year interval, we remembered everything, but what had happened to the bottle capper? However, quart-sized jars served the purpose nicely.

Early root beer recipes were carefully guarded family secrets. Inherited with the family name, few of these mellow formulas have been preserved in writing. We never did discover what made Great-Aunt Mary's the best at every Sunday school outing.

Back in the days when each rural family was a self-sustaining organization, the ingredients for root beer were harvested on the farm or bordering forest. Children scouted for root beer material on their woodland rambles, and hunters reported finds of sarsaparilla or spikenard. Farmers with a liking for the drink left stands of sassafras along the fence rows, and sweet birch in the woodlot.

Varying with locality, flavors depended on what was growing in greater abundance. Inhabiting much of the same territory, wintergreen and black birch thus offered a choice, as both yield oil identical in flavor and chemical composition. The birch was generally used because in quantity it produced more oil than the tiny creeping wintergreen.

Gathering, drying and distilling roots and herbs, required considerable time and effort. It is little wonder that later generations (Continued on page 330)

Long-lived Snakes

By GEORGE P. MEADE

"How long does a snake live?" The answer must be qualified by adding "in captivity," since relatively little is known of the maximum age that snakes attain in the wild.

Fairly accurate records of the larger and more spectacular snakes, such as the boas and the pythons, have been kept in zoos. These snakes are generally the most valuable ones in the collection, and they are also the specimens most easily singled out by keepers for attention and care. The age of the smaller, harmless snakes, with rare exceptions, has attracted little attention until recent years. Two independent longevity records, one by Cyrus Perkins of the San Diego Zoo and the other by Roger Conant of the Philadelphia Zoo, are now being compiled annually for snakes that have been in captivity in the United States for more than ten years. The British and European zoos are also compiling similar records.

Personal experience in keeping one of the most beautiful of the smaller varieties of snakes in captivity will contribute some surprising data on the question of longevity. The story begins in June, 1936, when four excited high-school freshmen, who knew the commoner local snakes fairly well, appeared at my door about eight o'clock in the evening with an "unknown" in a cardboard box. The story is not finished yet, as this hardy individual is still living at this writing, nearly 18 years later.

The youngsters who made the catch, now married men with families, had captured the snake near a grocery store about two hundred feet from my home, and were sure that it was "poison." To the small fry in Louisiana a snake is poison, not poisonous. In this instance, they had more justification than usual for fearing the snake, as it was a "mimic coral snake," one of several species that closely resemble the dangerous coral snake in pattern and coloration.

The new captive was a familiar variety to me as I already had one, in my backyard collection, that had been captured in May, 1932. The species is *Lampropeltis doliata amaura*, referred to in the reference books as "Cope's milk snake," but more generally known as one of the scarlet king snakes. The new specimen was about ten inches long and was at least a year old at time of capture, since hatchlings that I have had in my collection are only about five inches long.

The earlier specimen, then four years old, was about fifteen inches long and was known to be a female as it had laid an undeveloped egg in 1934. The first snake was known as "Scarletina" but the second captive has never had a name, and is generally referred to as "the other one," or by my herpetological friends as "amaura." It was hoped that the second might be a male, and that mating and eggs would result, but nothing like courtship and mating activities were noted, and it was concluded that both were females.

The size and pattern of this mimic coral snake are shown here. The snake is twenty-two inches long and about as big around as one's little finger. The protruding tongue, caught in the flash picture, makes the snout appear pointed instead of rounded, as is actually the case.

The two lived peaceably together in a portable wooden cage about 12″ x 15″ x 12″, with front and back panels of glass and hinged top of wire mesh. This home is kept in a large pantry just off our kitchen for most of the year, and on the back porch in the summer. A water dish, and a brown, flat, cardboard box such as books are shipped in, complete the living quarters. In the winter a woolen cloth is stuffed into the cardboard box for warmth. Both these attractive little snakes feed freely on the common green lizards, *Anolis caroliniensis*, which are plentiful here. Thus the feeding question, always a bugbear to the snake-keeper, has never been a problem.

These snakes are true "coral mimics" having much the same pattern, color, and conformation as the deadly coral snake, the only representative of the cobra family in the Western Hemisphere. The two types of snakes—the harmless and the poisonous—are brilliantly banded in red, yellow, and black, and both are small and harmless-looking to the novice. This harmless appearance can be most deceptive, as I know personally of a fatal accident that occurred may years ago when a Boy Scout picked up a coral snake in the mistaken belief that it was a scarlet king. A good rule is to let all brightly-banded small snakes alone unless you are an expert, although the arrange-

ment of the bands is a reliable guide to the initiated. The coral snake has the bands running red, yellow, black, yellow, red; that is, the red and yellow are separated by narrow black bands. Actually my two *amaura* had oyster-white bands instead of yellow, although "Scarletina" developed an over-lay of brownish color on the white bands as she grew older.

One unfortunate and unreliable differentiation given in many reference books, is that the snout of the coral snake is black, and of the mimics red, but this is not true of my two snakes, although I did have one scarlet king (subspecies *elapsoides*) that had a brilliant red snout. The nose of *amaura* is black with grayish tip, much as if a black leather hood was slightly worn at the snout. This mistaken statement emphasizing the black snout as the mark of the coral snake has resulted in the killing of several *amaura* in this vicinity, one specimen being sent me in alcohol from across the river. It was by far the largest and stoutest-bodied of the species that I have ever seen, sacrificed because of its black snout.

The first snake captured in May, 1932, died in July, 1944, after twelve years and four months in captivity, probably a record for such a small snake up to that time. Of great interest to snake men was the fact that about fifteen months before she died the tongue-motion in this snake ceased entirely, and it was believed at the time that the snake would die quickly or show great trouble in feeding. There was no evidence that the lack of tongue-motion affected the snake's health or its readiness to feed, nor was it ever established that the failure of the tongue to protrude in the usual way had anything to do with the death of the snake.

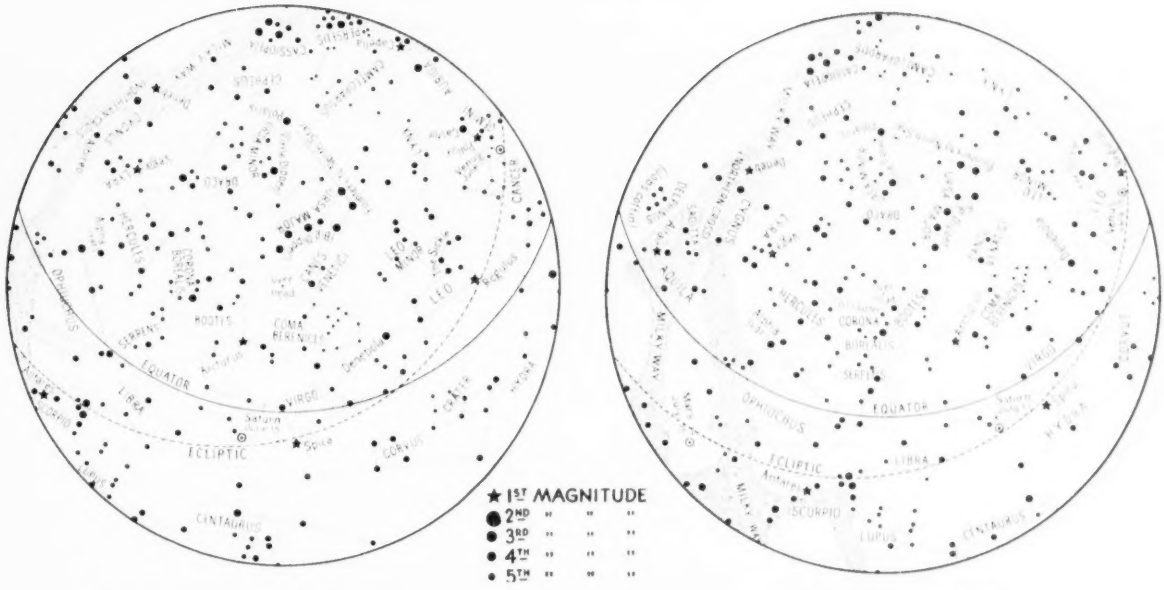
This eighteen-year-old captive is nervous and resents handling. The colors are red, black, and oyster white with the red bands the wider ones.

It will probably surprise many readers that snakes of the same species, like other individual animals, differ markedly in temperament and character. Of the two amaura, the older one, "Scarletina," was always quiet, liked to be handled and fed readily in the presence of an audience. The other one, even after nearly eighteen years of captivity, is nervous, resents handling and will frequently bite, although the teeth are so small as to make the bite almost unnoticeable.

Another difference between the two snakes was that the older one never showed any marked propensity for escaping, whereas the second captive is, like many king snakes, a "Houdini" when offered the least opportunity to work out of the cage. On one occasion, several years ago, about 11 o'clock at night, with no one else in the house, I was astonished to see this snake, who was supposed to be reposing securely in its cage in the pantry, come "swimming" across the waxed floor of our living room. Recapture was easy enough, but another time, when the housemaid loudly and excitedly announced that the snake had been seen disappearing under the door of a large cupboard beneath the stairs in our hall, the problem was not so simple. Like most such cupboards, this one was pretty well filled with a conglomeration of household effects and it took about twenty minutes of careful digging to find the snake under the accumulation. Following this rather trying experience, the top of the cage has been well weighted and no further escapes have occurred.

Besides the readiness to feed, both these captives have been especially noteworthy for the ease with which they have shed their skins. It has never been necessary to assist either of them in shedding, as is so often necessary with captive snakes. A record of the moltings was kept some years ago and it was found that the older snake shed eight times in five and one-half months, but during the summer months, June 11 to September 20, shedding occurred regularly every twenty days, more often than would be expected by most snake people.

Saturday has become regular feeding day for the present captive, and she eats from three to four fairly large lizards each week during the summer. Monthly feedings are the rule during (Continued on page 330)



9 P.M. June 1; 8 P.M., June 15.

9 P.M. July 1; 8 P.M., July 15.

To use these maps hold them before you in a vertical position and turn until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south. Times given are Eastern Standard.

The Evening Sky in June and July

By ISABEL M. LEWIS

THE total eclipse of the sun that will occur on June 30 will be one of the outstanding astronomical events of the year. Scientific observations of this eclipse will be made at a number of stations scattered along the path of the total phase, which extends from northeastern Nebraska, over the extreme northwestern corner of Iowa, through a southeastern part of South Dakota, and from there across Minnesota diagonally to a northwestern region of Wisconsin and over the Keweenaw peninsula in upper Michigan and across Lake Superior to Canada. The width of the path in the United States will increase from about 68 miles in Nebraska to about 76 miles at the end of the Keweenaw peninsula.

After crossing Lake Superior to Ontario, the path of total eclipse will include within its limits Otter Head and Heron Bay on Lake Superior, White River and Kapuskasing in northern Ontario, Rupert House on James Bay, which is directly on the central line of the path, and the Okak Islands off the coast of Labrador. The altitude of the sun on the central line of the path of total eclipse at the middle of the total phase on the Labrador coast, in latitude about 57½ degrees north, will be about 29 degrees; the width of the path of total eclipse there will be about 88 miles, and the duration of the total phase of the eclipse about 116 seconds. The middle of the total phase of the eclipse there will occur at 7:55 A.M., Newfoundland Time.

It is expected that some scientific observations will be made in Greenland, where the path of total eclipse will pass over the southwest coast from Arsuk to several miles south of Lichtenau. The central line will pass close to Igaliko, and will leave the east coast between longitudes 42-43 degrees west of Greenwich and latitudes 61-62.5 degrees north. It will leave the east coast shortly before 9 A.M., local time. The altitude of the sun will be about 40 degrees, and the duration of total eclipse about 135 secs. The width of the path has increased to about 92 miles.

The extreme southern coast of Greenland will not be within the path of total eclipse. The *southern limit* of the path of total eclipse will pass about 50 miles north of the extreme southern tip of Greenland.

The northern limit of the path of total eclipse will be farthest north in longitude about 22 degrees west of Greenwich off the southwest coast of Iceland, where its latitude will be about 63.6 degrees north. Although the central line of the path of total eclipse will pass about 37 miles south of the southern coast of Iceland, the town of Dyrholar on the south coast of Iceland, in latitude about 63.4 degrees north and longitude 19.5 degrees west of Greenwich, will be inside of the path at

a distance of about 11 miles from the northern edge of the path. The duration of the total phase of the eclipse at Dyrholar (Portland) will be 99 seconds.

Southeast of Iceland the path of the total phase of the eclipse turns in a southeasterly direction toward the Faeroe and Shetland Islands and the coast of Norway. Thorshavn, in The Faeroes, lies near the central line of total eclipse. The middle of the total phase occurs there at about 12:19, Universal Time, and the duration is about 152 seconds. The path there is 94 miles wide. About 2 degrees east of Thorshavn the sun will be on the meridian at the middle of the total phase. There the altitude of the sun will be 51 degrees at mid-totality. Only one island of the Shetlands, Unst, the northernmost of the group, and the northern part of it only, lies inside of the path of total eclipse. The town of Bergen on the coast of Norway lies 14 miles north of the central line of the path, which will pass over much of southern Norway and Sweden. The northern limit will pass about 12 miles south of Oslo and the southern limit 6 miles north of Goteborg. The island of Oland, off the east coast of Sweden, with the exception of the extreme southern part, is within the path, and the southern part of Gotland in the Baltic. Memel, in Lithuania, and Kiev, in the Ukraine, are within the path. In the late afternoon the path passes over Asterabad in Iran, and through Afghanistan and Pakistan to northern India, where it will pass off the earth at sunset. Partial phases of the eclipse will be seen by those who are within the much larger eclipse region outside the path of the total phase. The magnitude of the greatest eclipse decreases as the distance of the observer outside the path of total eclipse increases. Duration of total eclipse is zero at the limits of the path of total eclipse.

Partial phases of this eclipse will be observable over all North America, except southwestern parts of the Alaskan peninsula, far western and southwestern parts of the United States, and Mexico. The north Polar regions, north Atlantic Ocean, all of Europe and northern Africa, and Asia, except the eastern part, will be within the eclipse region.

In the regions in the United States where the eclipse will be visible, either the sun will rise more or less eclipsed or the eclipse will begin in the early morning. Greatest interest will be centered, of course, upon the path of total eclipse only within which one may see the solar corona, the appearance of Baily's Beads at the beginning and ending of total eclipse, the appearance, possibly, of brilliant solar prominences rising from the limb of the eclipsed sun, shadow bands passing across the ground directly before and after the total phase, and the brightest stars and planets near the sun shining forth temporarily. The sun will be near the horizon when the eclipse is total in this country, only about 10 degrees above it at Lake Superior, near the end of the Keweenaw peninsula, at mid-totality, and only 5 degrees near Minneapolis. If one plans to be within the path of total eclipse at sunrise on June 30 one should be sure of an unobstructed view of the position where the sun is to rise. Houses and trees, or any other objects on the horizon, might completely hide the sun from view in the few critical moments of total eclipse. Favorable positions to see the eclipse may be found along the path at or near Sioux Falls S.D., Minneapolis and St. Paul, Minn., Hayward, Wisc., and almost any position on the Keweenaw peninsula.

If one wishes to obtain much detailed information regarding the times and circumstances of this eclipse it may be found in a small publication which is a Supplement to the American Ephemeris, 1954, and is entitled, "Total Eclipse of the Sun, June 30, 1954." It contains 42 pages and three maps, two of which are large-scale maps of the path of total eclipse and show the times of the beginning and ending of the eclipse and of the total phase for places within the path in the United States, Canada and Greenland. This publication may be obtained by writing to Superintendent of Documents, Washington, 25, D.C., and enclosing 40 cents. This pamphlet will be found, also, among the reference books in some of the larger public libraries in some cities.

If one is located within the path of total eclipse near Minneapolis, the sun will rise partly eclipsed and the total phase will occur at about 6:08 A.M., and it will last about 75 seconds only, less if one is not on the central line. The partial phase following total eclipse will end there at about 7:03 A.M. These times are in Eastern Standard, or Central Summer Time.

The times of the phases of the eclipse at Washington, D.C., in Eastern Standard Time, are—Beginning, 5:05 A.M.; Greatest Eclipse, 5:57 A.M.; Ending, 6:55 A.M. The magnitude of the greatest eclipse at Washington will be about 73 hundredths, which is the part of the sun's diameter covered by the moon at the time of greatest eclipse. These times will not differ more than a few minutes at most from the corresponding times from Richmond to Boston, and at most places in the mid-Atlantic and northeastern States, where the greatest magnitude will not differ more than a few hundredths from that at Washington.

On July 15 there will be a partial eclipse of the moon, which will be visible generally in Europe, Africa, and South America. In North America the eclipse will begin before the moon has risen. The ending of the eclipse will be seen only in the eastern and southeastern part of North America. The magnitude of the eclipse, or part of the moon's diameter covered by the shadow at greatest eclipse, will be about 41 hundredths. Greatest eclipse will be at 7:20 P.M., (Continued on page 332)

Night Is An Eagle

By ALMA ROBISON HIGBEE

Night is a black eagle hiding
Far from the haunts of day,
He waits in the deepest shadows
Till darkness is on the way,
Then he leaves his secret covert
With great wings lifting high
And folds them down to hover
Star-eggs in the nest of sky.

The School Page

By E. LAURENCE PALMER
Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education, The American Nature Association

CIVILIAN DEFENSE

THE month before this is written will go down in world history. It will not be because of this article but because during that month two hydrogen bombs were exploded in the Pacific, with repercussions that have not as yet subsided and possibly never will. We have been provoked to sober thought about what might happen should such a bomb drop within the area of the earth with which we happen to be familiar. We have been asked to join with our neighbors in preparing some sort of defense against the danger. I have just finished training my third class of Block Wardens, using data based almost entirely on the damage caused by the relatively puny A-bombs dropped on Japan during World War II. What a contrast there has been between the pioneer thinking of those who have probed the possibilities of thermodynamics, and its related fields, and those in the education field who are in places of strategic importance but lack the imagination of the research physicists, and their willingness to recognize that we live in a new world and that the lecture notes of a generation ago need either to be discarded or to be completely revised.

This warden training experience was real fun because, while I had to present material that would enable my students to pass an examination based on the facts presented by the earlier A-bomb explosions, I had also to satisfy my conscience and present something of the facts presented by the latest H-bomb explosions. It seems to me that teaching is always something of that sort of combination. The question is who is going to "call the shots." To pass examinations, we often have to be conservative stick-in-the-muds, but to meet the situation on the firing line we must be on our toes and armed with the most advanced information. I once knew of the experience of a number of candidates for a major position in science education. Three or four admirable candidates were rejected because they could not glibly recite a list of the cardinal principles of education, while the candidate selected would be hopelessly lost to explain the environment encountered on a field trip across his own front yard

I wish we in science and education could bring together the finest thinking of the scientist and of the educator. Now much of this thinking is at cross purposes, and, as a result, unproductive. If any heat is generated, it is because of resentment about the questioning of pet theories that should long ago have been rejected. Even the printed commentaries that might be helpful are often futile because they are usually printed for consumption by groups already convinced. In the April, 1954, issue of *The American Scientist*, there appears an article of Robert T. Lagemann on "General Education Courses in Science." This should be read by every science educator. Since the magazine is distributed primarily to members of Sigma Xi, the society honoring research ability in science, it is not likely that it will be read by many of the members of the National Association for Research in Science Education, few of whom are members of Sigma Xi. Yet Lagemann's article, even with its shortcomings, should stimulate constructive thinking by fair-minded folk, even though its basic weapon is ridicule.

The average teacher and the average pupil is the civilian in this situation. They must organize their own defense, just as we had to draw up our own program this week in training that group of Block Wardens. The average teacher and pupil must have the courage to say to those in authority that it is, in the long run, less likely to find dependable help from those who have glib shibboleths to meet situations than to derive aid from those who have a sound mastery of at least some field of science. Of course, mastery of the content of one field of science does not give authority to speak for another field necessarily, but neither does a doctorate in science education give authority to speak reliably for all fields of science, and for education as well.

At a recent meeting of the Committee on Biological Education of the National Research Council the problem of training the mill-run teacher in the field of science came up for consideration. Definite recognition was given to the need for planning science offerings, not only for the research specialist but for those who may become technicians, or just common citizens, so far as their science interests are concerned. Contrary to what so many science educators have contended, the members of the Council emphasized and reemphasized the importance of laboratory work, and, particularly, laboratory work in the field.

Just this week I received an elaborate dosier presenting plans and equipment for the ideal school science laboratory. I fail to find in it any provision whatever for living plants, or animals, or for the study of either. No suggestion is given as to how the laboratory may be used in partnership with the field, or recognition of the fact that the laboratory without a supporting field is like a one-legged man. Frankly, I feel that, while elaborate laboratories and equipment are often useful, it is basic to guaranteed success in science education that a teacher be trained in both science and education, and exposed to an overwhelming amount of common sense. We have too many workers in the field who are supported by but one of these three legs. The situation under these circumstances may at times be precarious.

Basic civilian defense to meet the threats of a hydrogen bomb, or to meet the demands of a new civilization based on an industry whose whole concept of the production of power is being revolutionized, calls for cool heads and for determined insistence that sham be thrown out the window. Should the H-bomb rule our world through war, little that is at present incorporated in the basic training program for Block Wardens can be of value in the future. The whole program calls for the acquisition of new concepts and the willingness and ability to meet new situations with new ideas, new resolution and new systems of behavior. Not all civilian defense should be based on the probability that the H-bomb will be used in war. Should its power be used primarily for the advancement of peaceful pursuits it will revolutionize much of our social structure. Coal miners who, in part through poor advice, encouraged the public to seek and to find better sources of heat for their homes and for their industries will be pushed farther on the defensive if that power can come from some other useful source. Industries equipped with cumbersome machines getting power from water, steam, electricity and other means will be faced with competition from firms using more modern means. Civilian defense in time of peace or of war is to become a necessity. We will need Block Wardens in either case, that is we will need the grassroots workers on whose efficient performance of their duties falls the whole basic responsibility for a total success.

We are told that the time may come when a handful of fuel may be sufficient to run a giant locomotive for a year or more. We are told that bombs dropped in Nevada affected photographic films in New York State; that bombs dropped in the western Pacific affected Montana: that a bomb dropped in central New York State might well have serious effects on the whole State. We have reason to believe that there is some truth in these statements. We like to have faith in the men whose thinking produced this situation, faith that they or their counterparts in the world of human affairs can solve the equally significant and staggering problems in the social science field. I, for one, do not believe it will be solved by persons without some basic understanding of natural science *and* of social science. I, for one, believe that it will never be solved unless our whole civilian defense against these major influences on our future becomes itself intelligent, alert and willing to serve man and a world society of men.

I firmly believe that, while a handful of fuel may some day run a locomotive for a year, a handful of fools might tomorrow wreck the whole world for many years. I do not believe that all these fools are in any one country, or that they are all in places of political significance. I believe that on the "Block Wardens" in education may fall the major responsibility and to them, in the long run, may come the greatest reward.

Camera Trails

By

EDNA HOFFMAN EVANS

HOW many people visit our National Parks and Monuments every year? Last year it was more than 46,000,000. This year it will certainly be no fewer. And the great majority of such visitors will carry cameras and take many pictures of the areas they visit.

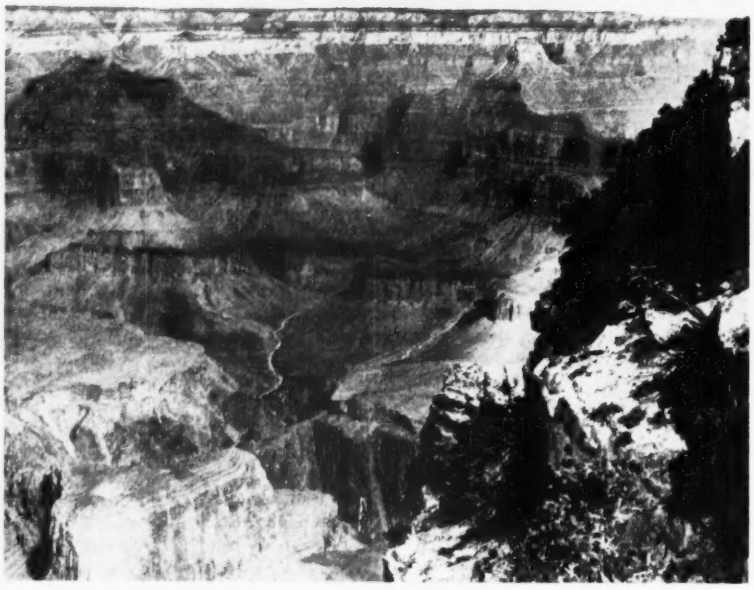
For myself, whenever I visit a National Park or Monument—which I do whenever opportunity permits—I never cease marveling at the vast amounts of amateur photography being done therein. Truly, the camera and film manufacturers of the country should be everlastingly grateful that the National Parks exist.

Being greatly interested in photography myself, I am also interested in photographers. I like to notice what kind of cameras they have, and I try to figure out why each one chose that particular kind. I have plenty of room for speculation for there are all sorts of cameras—cheap ones from the drug store, expensive ones from this country and abroad. There are shiny new ones bought obviously for this particular trip, battered old relics from the attic, and well-worn ones that show evidence of long and steady use. There are large ones and small ones, with all kinds of lenses and sighting devices; there are movie cameras and still cameras; cameras of every size, make, and description.

In addition to noticing what kind of cameras people have, I also like to watch the way people use their cameras. Some cameras get expert, loving treatment; others are thumped and banged around so roughly that I wonder how they manage to hang together. Some are used skillfully, some are just pointed and punched haphazardly.

The photographers, too, are a varied lot. There is the gregarious type, the kind of person who insists on having all the family packed into every scene, and who often asks some stranger to "push the button so I can get into the picture, too." At the other extreme is the misanthrope, the kind who goes off by himself in search of solitudinous scenes far from the madding crowd. This sort of photographer has been known to snarl fiercely if someone approaches within a half-mile of his chosen hunting grounds.

There is the photographer who just aims and shoots; any scene seems to satisfy him. There is also the photographer who views the scene from this angle and that, who climbs on benches and picnic tables, lies flat on his stomach, and occasionally even seems to hang by his toes over a precipice in order to find just the right composition. Either that, or he waits patiently, minutes and hours on end, for just the right cloud effect, just the proper shadow, just the desired light. Then, and only then, will he take his picture.



The Grand Canyon is so vast and so magnificent that unless the photographer provides some sort of foreground, like the ledge shown on the right, he has no measuring stick with which to show distance.

As I watch them in action—those people and those cameras—I cannot help wondering about the results, photographically speaking. Will the family pictures be cherished in albums and shown to all the friends and neighbors? Will there be anything to show, or was the camera jarred at the time of exposure; was the film carelessly handled and light-struck when it was being put in or taken out of the camera?

"Center of interest" does not mean center of the picture. Note how the absence of any detail in the center of this photograph emphasizes the vastness of the horizon. The mangrove tree frame holds the small tug—the actual center of interest—in the picture.

Will those painfully made shots be all the photographer hoped they would be? Will the long-awaited effects be right? Will the movies be viewable? Will the color transparencies be a recognizable rendition of the scene when they are placed in a viewer or projected onto a screen?

Will my pictures be good? Will yours? Will all of us who take ourselves and our cameras to National Parks and Monuments this summer have something to show for our efforts when the trip is over and we are back in our everyday stamping grounds once more?

The answers to those questions and satisfactory results from all our efforts depend largely on ourselves. We can, to a great extent, control the success or failure of our vacation photography. To do this we must make a few efforts, exert a few pains, and make sure that we handle our equipment with the skill and respect it deserves.

Our vacations usually take us into new and different parts of the country. That is what makes them vacations. And the National Parks, those "public parks or pleasuring grounds for the benefit and enjoyment of the people"—to quote from the Congressional Act that established the first of them back in 1872—are usually very different from the regions where we make our homes. They present new and unfamiliar conditions that play a vital part in success or failure of photography.

Light, for example, is vastly different at 5000 feet elevation than it is at sea level. Reflections are brighter at the beach, or on the water, than they are in wooded areas. If you are a careful cameraman, and if you are using color film, you will lean more heavily than usual on your light meter for it is far more dependable in strange environments than your own judgment of the light situation.

But good photography technique is good photography technique, and bad is bad, regardless of whether you practice it while visiting some National Park or in the privacy of your own back yard. The results you get, technically, will be proportionate to the amount of skill and patience that you put into the taking of your pictures.

One thing, however, that we vacationers tend to overlook in our eagerness to capture every aspect of our trips to new and different places is relativity. I do not mean relativity in the Einstein sense, but rather in the sense of relative sizes—the size of a limitless view that stretches to the horizon and the size of the film on which you wish to capture that view. I mean also the difference in our emotions as we let our eyes rest on such a view, while the breeze rumples our hair, the sun warms our skin, and we have the free, untrammeled feeling that vacation gives us. At that time everything looks wonderful. Everything begs to be photographed—that long, rolling sweep of prairie with the cloud patterns moving across it; that distant blue range of mountains that humps itself up on the horizon; that white fleck of sail in the distance; that deer feeding in the sun-dappled shadows of a parkland thicket.

The chances are, when we get back home and have our slides or films developed, we are going to find such general scenes far from satisfying. Lacking the environmental and emotional factors that accompanied the originals, those two-dimensional pictures are going to seem flat and tasteless. We will wonder why we wasted so much film on such uninteresting subjects.

Those of us who have squeezed the family into every possible picture are going to be better satisfied with our results than the photographers who tried to capture vast expanses of Nature without human interference. Why? Not necessarily because the former were better photographers, but because (unconsciously perhaps) they included one vitally important detail in their pictures. That detail was a center of interest.

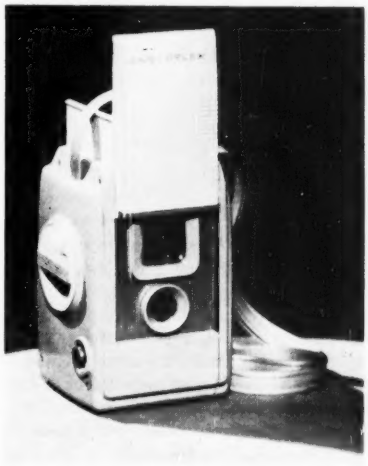
The photographers among us who want scenery can learn a lesson from the snapshooters. We too, must find a center of interest for our pictures. No more of this shooting at distant horizons. Instead, we must focus on something definite, we must have a theme, we must make each picture tell a story.

We must find an interesting rock, a tree, perhaps a log, or even a bush or flower to focus attention on. Then the rest of the scene falls into place and we have proportion, a picture with relativity. If it is distant scenes that we want, we must frame those scenes with something close to us so that our picture can convey the feeling of distance.

In obtaining this center of interest, we must not forget what we know of composition. "Center of interest" does not necessarily mean "center of the picture." In fact, better composition usually demands that the main object not be located dead center. The horizon line should not cut through the horizontal center but, instead, should be placed so as to emphasize the most important feature. If it is cloud effects we are stressing, then the sky should probably occupy the greater portion of the picture. If the sky is unimportant then it should be given less space. Our rocks, our trees, our other centers of interest, should be placed similarly—left or right, above or below, as the case may be—but placed so that they draw the eye into the picture, give it something definite to focus on, and then lead it surely but unobtrusively to the other portions of the scene.

If we do this, we who are more interested in scenes than in people, we, too, will bring home satisfying pictures from our vacations.

I notice, in looking back over these paragraphs, that I have wandered far afield from my original topic, from National Parks and Monuments to the more general subject of vacation photography. There is still a great deal I want to say about photography in the National Parks. Next time I will try to stay with the original subject.



This Anscoflex model is really a "new look" in camera design.

IN THE CAMERA LINE Ansco has presented a smart new look in its Anscoflex, a two-tone gray and silver camera with a sliding panel to protect its two lenses. The camera has many additional new features, designed for both

(Continued on page 332)

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Yellow-breasted Chat	Slate-colored Junco
Catbird	Swamp Sparrow
Brown Thrasher	Savannah Sparrow
Mockingbird	White-crowned Sparrow
Song Sparrow	Harris' Sparrow
Lark Sparrow	White-throated Sparrow
Dickcissel	Caroline Chickadee
Chipping Sparrow	Black-capped Chickadee
Field Sparrow	White-breasted Nuthatch
Pine-woods Sparrow	Red-breasted Nuthatch
Red-eyed Towhee	House Wren
Goldfinch	Bewick's Wren
Indigo Bunting	Winter Wren
Painted Bunting	Killdeer
Blue Grosbeak	Barn Swallow
Bob-White	Eastern Kingbird
Crow	Olive-sided Flycatcher
Fish Crow	Alder Flycatcher
Yellow-billed Cuckoo	Least Flycatcher
Blue Jay	Ovenbird
White-breasted Nuthatch	Black-and-white Warbler
Whip-poor-will	Tennessee Warbler
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Barred Owl	Redstart
Purple Martin	Chestnut-sided Warbler
Summer Tanager	Hooded Warbler
Robin	Canada Warbler
Bluebird	Magnolia Warbler
Wood Thrush	Blackburnian Warbler
	Black-throated Blue Warbler
	Black-throated Green Warbler
	Cerulean Warbler
	Prairie Warbler
	Veery
	Gray-cheeked Thrush
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LONG-LIVED SNAKES

(Continued from page 324)

the winter, when lizards are not so readily obtainable. An interesting point about this long-lived specimen is that no effort has ever been made to give it sunlight or artificial radiation. My friend Marlin Perkins of television fame is of the opinion that the lizards, which bathe in sunlight, supply the snake with all the Vitamin D required and therefore no artificial feeding or radiation is necessary. Whatever the reason, the natural feeding simplifies matters greatly.

The answer to our question about how long a snake lives is quite evidently "Longer than you think." Here, we have two slender and apparently delicate snakes, of a species that is listed as "rare" by the authorities, one of which died when four months more than twelve years old, the other still living eighteen years after capture, a combined captive life of thirty years. The results should encourage amateur hobbyists because the conditions that have supported this long life are a simple portable cage, natural food and a minimum of care. The type of study described is especially suited to amateurs since they are frequently in a better position to carry longevity records than are the professionals in the zoos. Also, it is a lot of fun.

ROOT BEER, ALL-AMERICAN DRINK

Continued from page 322)

have sacrificed tradition for the convenience of store-bought extract.

Charles E. Hires, Sr., a Philadelphia pharmacist, packaged one of these formulas and wa selling it at his drugstore before 1869. This handy dried mixture was steeped in hot water with sugar and yeast.

About 1876, the year of the Philadelphia Centennial celebration, Mr. Hires adopted the name of root beer for his drink. This met with the approval of the temperance societies, which were waging war on the sale of beer and spirits in the coal mining areas of upstate Pennsylvania. It was believed the name would have a psychological effect on the miners, who would think they were drinking a form of beer although it was non-alcoholic. The following year, the Hires product appeared on the market as liquid extract.

Root beer has earned a place of honor among such distinguished native dishes as succotash, cranberry sauce and roast turkey. Carbonations and cooler combinations are legion, but root beer has retained its perennial popularity. Somewhere between wars, most of us got out of the habit of making our own, but not enough to forget fully the taste.

You cannot recapture your lost youth, but you can still enjoy the flavor of barefoot summer yesterdays, for the piquancy of the American outdoors has been bottled to recall pleasant memories. Distilled from Nature's roots and topmost branches, each glass is the reflection of sassafras, rambling brightly across October meadows, of Christmas-berried wintergreen and graceful black birches, black against the upland snow. You may have to hunt for the extract on your grocer's shelves, but root beer tastes better than ever, and it is economical and easy to make.

TAGUA

(Continued from page 319)

from natural nut to finished button, soon became standard practice, but it never overcame one major difficulty—Nature did not standardize the size or shape of a *Phytelephas* seed! Each tagua nut was an individual problem to be solved on the spot by the man slicing it on his circular saw. Naturally this slowed up the mechanical assembly line and also, unfortunately, often resulted in lost fingers for the operator.

Vegetable ivory buttons became enormously popular. Manufacturers turned them out by the million, the garment trade bought them in steadily growing quantities, consumers liked them for their practical qualities (usually without knowing a thing about tagua!), and Ecuador rejoiced in the growing demand for one of her native products.

But this satisfying rise was the beginning of the end of an industry. By 1941, according to an Ecuadorean economist, tagua "had diminished *notablemente* in commercial value." The reason? Synthetics had arrived! Remorselessly, buttons made of plastics worked their way into popular favor. As the "bugs" were engineered out of the new materials, forward-looking button manufacturers rapidly expanded their plastic "line." Before long the thirty-five factories turning out tagua nut buttons had been reduced to ten. Today only one factory in the U. S. makes them! An executive of a large button company in New York told me that vegetable ivory buttons now comprise less than one percent of his stock. This plummeting fall is reflected in the dismal figures of Ecuador's current tagua export, which has fallen off more than two-thirds in less than fifteen years.

It is an unhappy situation, but by no means a new one. In the course of what we consider "progress," all sorts of things —some of them firmly entrenched in public favor for generations—have been forced out of the industrial mainstream into a backwater of near-oblivion. The case of the tagua nut has an element of pathos apart from the purely practical considerations of national economy. In the nut-gathering stage tagua has always meant a little extra cash for the native untrained to do more remunerative work. Now he has lost most of this "poor man's wealth."

The future of tagua is uncertain. Unless modern technology turns up a new use for it, this forest product so lavishly supplied by Nature, will soon be lost once more in its native jungles. The amount of vegetable ivory that goes into tourist knick-knacks and such hardly makes a dent in the production possibilities. Button manufacturers discovered that tagua waste made excellent fuel for their factory furnaces; perhaps the nuts could be shipped in profitable quantities to areas lacking more conventional fuel supplies. According to the Pan-American Union Division of Economic Research, experiments are currently going forward in the use of tagua as concentrated food for dairy cattle. Plainly, the solution of the problem, which means much both to the government of Ecuador and to a considerable number of her humbler citizens, will need these two indispensables —imagination and research.

TORNADOES

(Continued from page 296)

School buildings and factories, having larger window spaces and fewer inside partitions, are not the safest places in which to survive a tornado. As in the case of an atomic bomb, people are advised to stay away from windows, and to huddle against inside walls or, better still, in storerooms and closets. It is generally thought that modern concrete, steel-reinforced structures are capable of withstanding the direct force of the tremendous winds. However, as yet, few such buildings have been put to that supreme test.

Thus far, the tornado picture has been painted as very dark, indeed. And dark it is, but not totally so. After all, there are more than three million square miles in this country and the possibility of any single square mile being visited by a tornado within any given year is remote. According to Weather Bureau estimates, in Iowa the chance is one in 1203; in Kansas, one in 1613; in Arkansas, one in 1933; in Oklahoma, one in 2262; in Illinois, one in 3987; and in Indiana, one in 3559.

The odds for individual survival have been worked out, also. It is estimated that, over a 68-year lifetime, a resident of Arkansas has one chance in 1490 of being killed and one chance in 115 of being injured by a twister; in Mississippi the chances are 1529 and 118; in Oklahoma, 1684 and 130; and in Kansas, 5736 and 441.

So, as far as the tornado threat is concerned, it is really no worse than it ever was—the twisters are just better reported. And as for our chances of living to a ripe old age, they are far better with respect to the twisters than they are on the highways, or even the byways, of the nation.

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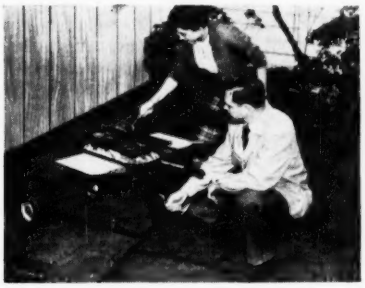

Backyard chefs are given an assist with the new barbecue outfit manufactured by R. D. Fageol Company of Kent, Ohio. This is known as **Trader Vic Combination** Model and consists of an efficient, lightweight portable grill to which can be added a **Trader Vic Oven.** The grill pan is 12 by 18 inches, adjustable for cooking rate. Finished in heat-resistant satin black, with fitting of dull chrome, this is said to be an attractive addition to lawn or patio.

Dynascope Reflector is a reflecting telescope with a four-inch paraboloid mirror and is a precision instrument of professional calibre at a popular price, according to the Criterion Manufacturing Company, 331 Church St., Hartford 1, Conn. Similar outfits have sold for $125 and up, and the cost of the whole telescope is less than the cost of one assembled at home. Complete, this reflector sells for $44.95, f.o.b. factory.

Made of heavy molded rubber compound, weatherproof and chipproof, the **Wren House** exclusive with David Vogt, Deford Crafts, Grafton, Wisconsin, is "really for the birds." Comes in natural acorn and oak leaf colors. It is shipped for $3.95, postpaid.

Laboratory Equipment Corporation' St. Joseph, Michigan, announces new **Leco-lon Latches** and **Magnetic Leco Latches** for cabinets, cupboards, etc.

Eastern Rotorcraft Corporation of Box 110, Doylestown, Pa., has a new boat tie-down for boat trailers. This is called **Grey Gripper.** It is rated at well over 500 pounds and sells for $7.95.

Andave Company, 1690 Coral Way, Miami 45, Florida, comes up with a couple of interesting items. One is a **Purse Shopping Bag** that folds up to carry in one's purse and weighs less than one ounce. Will hold at least 60 pounds and sells for one dollar, postpaid. The other item is a laminated handbag inspired by a fishing tackle box. Rounded corners, oval mirror inside lid, solid brass hardware, 5-1/8 by 9-1/8 inches. It is $11.00 postpaid.

Zenith Optical Laboratory, 1940 Great Neck Road, Copiague, L.I., N. Y., announces **Tri-Density Sun-glasses,** denser on the upper and lower portions of the lens, the center portion of neutral sage green color to eliminate normal glare without reducing visibility. Priced at $5.00 and satisfaction guaranteed.

Magna-Board is a new educational toy announced by Ohio Flock-Cote Company, 5713 Euclid Avenue, Cleveland, Ohio. Board has 90 letters and numbers that kids just press on the flock-coated surface and practice adding, subtracting or spelling. Sells for one dollar, postpaid.

Campers and picnickers have to be space-concious and will find useful the **"Tote-Table"** and camp stools available from Harmony House, Dept. H-6, 7340 W. Colfax Avenue, Denver 15, Colorado. The table folds and unfolds in seconds and carries like luggage. It is light, due to its tubular aluminum frame; has a ligneous plastic top; 10 square feet of table top. Chairs weigh 17 ounces but will support 200 pounds. Table is $21.95; stools $9.98 for a set of four in carrying carton.

THE TIES THAT BIND

(Continued on page 313)

youngsters' interest in any way we can. Knowing the world around us makes us feel at home wherever we may be. Near our home we pick wild blackberries. In Canada on our vacation we collected wild blueberries for muffins and pies and were "at home" with our surroundings. At dusk tonight the four of us walked from the garden to the house and paused together to listen to the nighthawks. Hand in hand we turned again to our home and I realized with a smile that years from now our children will write to tell us of a bird they have seen or a flower they have found. Our mutual love of the outdoors will be a special bond among us even when we are no longer always together.

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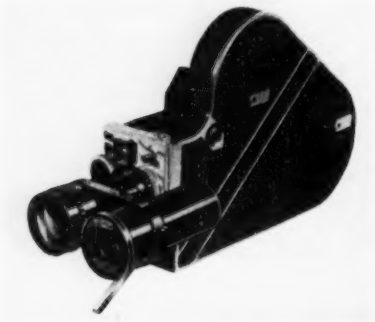
CAMERA TRAILS

(Continued from page 329)

eye appeal and photographic efficiency. It uses 620 size roll film. Its price is $15.95 for the camera, plus $3.50 for carrying case, and $4.95 for special flash unit. For more information write Ansco News Bureau, 175 Clinton Street, Binghamton, N. Y.

For vacation convenience, Eastman is offering a new Duo-Pak containing two rolls of film, one for immediate use and one as a spare. This way, the vacationist is supposed to be less likely to run out of film at a crucial time. The Duo-Paks are available in two speeds and sizes, Plus-X and Supper-XX, 620 and 120. The two packs cost less together than when bought individually.



The varifocal lens which, when attached to any 16mm. movie camera gives a variety of focal lengths without a change in turret.

A VARIFOCAL LENS

WHILE I am sure the following item will only be within "wishing" range for most readers, as it is for me, I think it is an interesting new development worthy of mention. Perhaps some day, just as many once-expensive devices have been brought within moderate pocket book range, this, too, may be available to us ordinary folks.

The new development is the Zoomar 16mm varifocal lens, a device which (so its developers claim) supplants conventional lenses from 25mm to 75mm and permits the user to switch from normal focal length to telephoto, to wide angle, without resetting his camera turret. The device weighs 1-1/4 pounds and is 5 inches in overall length. Also, it fits all 16mm motion picture cameras without alterations either to the camera or the lens.

According to the literature describing it, the Zoomar lens is the result of development that started some eight years ago for the motion picture industry. With the advent of television, the varifocal lens really came into its own and today it is said to be standard equipment in more than 100 stations.

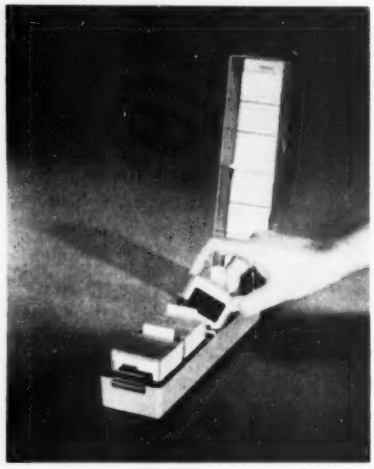
To quote directly: "Although designed with the amateur market in mind, the Zoomar 16 incorporates a professional, Hollywood-type coupled finder in its design. This wide-vision finder does away with the 'peephole' type of finder, permitting the cameraman enough freedom of movement so that he can actually edit his scene on the spot."

Technically speaking, the lens has an aperture range of from f/2.8 to f/16, a zoom range of from 8 feet to infinity, with short range adapters available for closer pictures.

The price, alas, zooms the lens far out of the ordinary home-movie fan's range. The lenses sell for $600. If you want more information about them, write to Zoomar, Inc., Dept. R, Glen Cove, Long Island.

And here are a couple of accessories that most of us can afford, if we need them.

Eastman has a new Kodaslide pocket viewer, actually pocket or purse size, that can be used for examining slides in mounts up to 2 x 2 inches. It gives a four-times magnification and sells for $1.95.



The Kodaslide Ready-File.

Also for slide fans is the new Kodaslide Ready-File, which will hold up to 200 standard color transparencies or 100 stereo mounts. Four index cards are provided with the file, allowing the slides to be divided into six different divisions. The box is of unbreakable plastic (polystyrene) material. It, also, is priced at $1.95

THE EVENING SKY IN JUNE AND JULY

(Continued from page 326)

and ending at 8:31 P.M., E.S.T.

Mercury will be favorably placed for observation around the time of its greatest eastern elongation on June 9, when it may be seen in Gemini, well above the western horizon, soon after sunset. It should be visible east of the sun during the total eclipse of the sun on June 30. In July Mercury will be at inferior conjunction with the sun on July 6. It will be at greatest western elongation on July 26, and visible as a Morning Star in the twilight preceding sunrise for a week or so before and after that date. Venus will be a fine evening star in June and July, setting about two hours after the sun

Mars will be at its best in these two months in the constellation of Sagittarius. It will be at opposition to the sun and visible all night on June 24, and nearest the earth at a distance of 39,740,000 miles on July 2. It will then be most brilliant, and for a brief period as bright as Jupiter when that planet is at its best.

Jupiter will be in conjunction with the sun on June 30, and when the sun is in total eclipse on that day it will be conspicuously in view close to the sun wherever the total eclipse is observable. In July Jupiter will be in the eastern morning sky, but too close to the eastern horizon to be seen until near the end of the month.

Saturn is east of Spica in Virgo, and east of the meridian at sunset in June. In July it will remain in Virgo and will be due south at sunset on July 26. It is now setting before midnight.

Summer begins on June 21 at 5:55 P.M., Eastern Standard Time, when the sun will be farthest north.

NEWFOUNDLAND'S ORCHIDS

(Continued from page 304)

woods. It is considered by many to be the most beautiful of all the northern orchids. Nevertheless, it has two close contenders in the yellow ladyslipper, *C. calceolus pubescens*, and the showy or painted ladyslipper, *C. reginae*, both denizens of the moister, mixed woods.

These, plus many more, such as the sweetly-scented ladies' tresses, rattlesnake plantain, several twayblades and the elusive calypso, *C. bulbosa*, all unite to make Newfoundland truly a northern orchid garden, and one practically unspoiled by the hand of man.

Honeybees

The Behaviour and Social Life of Honeybees. By C. R. Ribbands. Hapeville, Georgia. 1954. Hale Publishing Company. 352 pages. Illustrated. $4.50.

This interesting book is based upon studies by the author, who is principal scientific officer in the bee department at Rothamsted Experimental Station in England. It was brought out in Britain under the imprint of the Bee Research Association, Ltd. This book, which is written in largely popular terms, should be of great value to bee keepers.

LET'S GO FISHING

Answers: 1. drum; 2. cod; 3. sun; 4. angel; 5. cat (or dog); 6. stargazer; 7. pike; 8. archer; 9. sucker; 10. cobbler; 11. perch; 12. gold; 13. sole; 14. buffalo; 15. white; 16. bass; 17. grunt; 18. sail.

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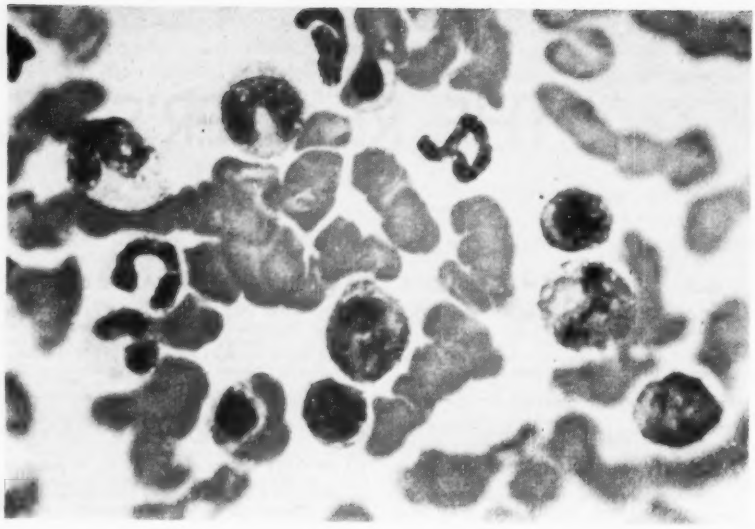
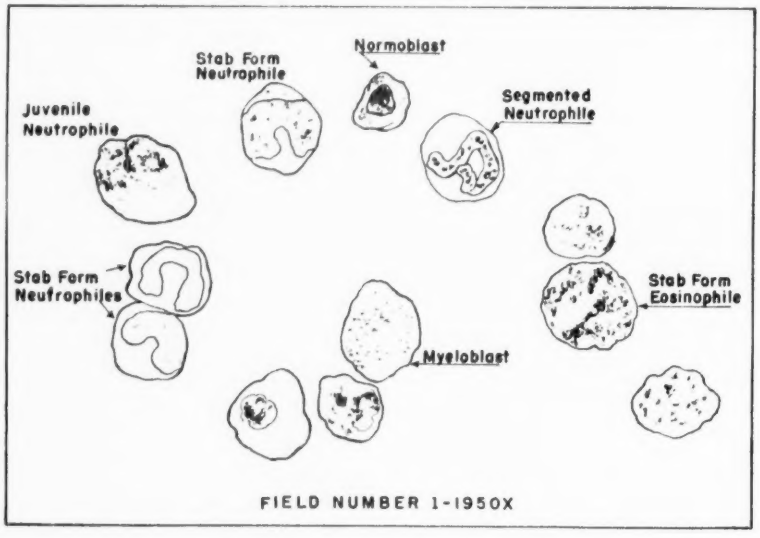
UNDER THE MICROSCOPE

By JULIAN D. CORRINGTON



Bone marrow smears from sternal puncture, Giemsa, 2000X.
Fields selected and cells identified by Miss Nielson, photomicrographs by John Butterfield, using 1.8 mm, 1.30 N.A., 98X Fluorite oil objective and 12.5X compensating eyepiece. Cells keyed in Ozalid prints.



THE BLOOD FACTORY

BLOOD is commonly treated in literary and other non-technical allusions as though it were a single, simple, or homogeneous substance. We talk about having "poor blood" or "rich blood," or say our "blood gets thin," much as we might discuss the oil in the crankcase of our car. Actually blood is about as complex a material as could be imagined. Part of it is alive, the corpuscles and platelets. Part of it is the product of living tissues, as fibrinogen or serum globulin, both native to the blood; or is a product that uses the blood as a means of transportation, like the hormones thyroxin or adrenalin; or occurs as an hereditary property, such as the substances that make one a member of blood group A, or Rh positive; or is present in response to foreign invasion, as antibodies. Part of it is digested food, as glucose or the amino acids, or ingested salts such as those of calcium or sodium; part is excretory waste, as carbon dioxide, and a large part is water. It is with the maintenance of the living fraction that we shall here be concerned.

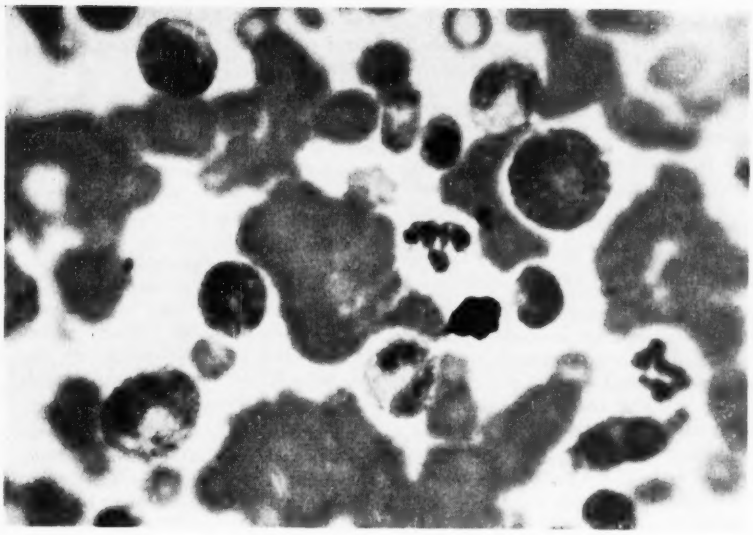
Formed elements of the blood—the corpuscles and platelets—wear out, or are lost or used up and must be replaced, an act termed *hemopoiesis* or blood-making. Organs that perform this function are the *hemopoietic organs*, falling into two classes, the *myeloid* (bone marrow) and *lymphoid* (spleen, thymus, tonsils, lymph glands, nodes and diffuse lymphoid tissue). There are seven kinds of formed elements; erythrocytes (red blood corpuscles), platelets, and five kinds of leucocytes (white blood corpuscles). These are lymphocytes, monocytes and three kinds of granulocytes (those with a granular cytoplasm), the neutrophils, eosinophils, and basophils. Five of the seven are formed exclusively in the marrow in normal adults; all except lymphocytes and monocytes, and even a small number of these are marrow products.

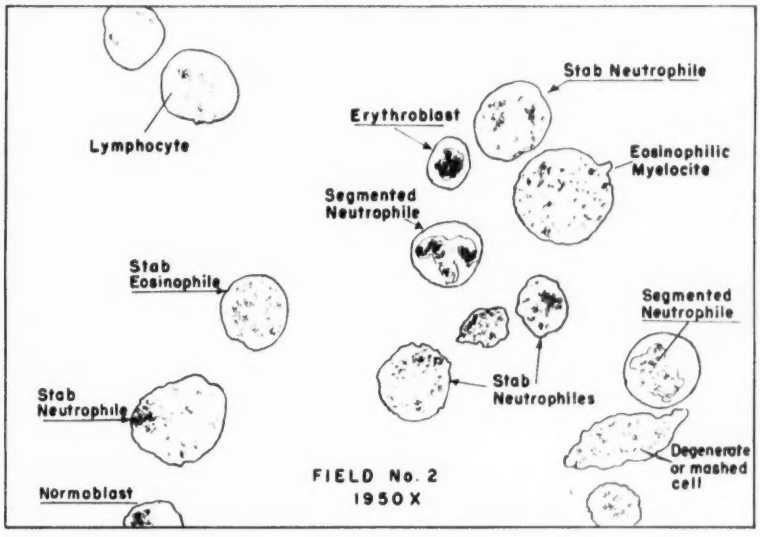
Hemopoiesis (also written hematopoiesis) begins before the onset of the second month of embryonic development in man. Mesenchymal cells of the yolk sac form *blood islands*, where both vessels and cells appear. All but a few of the corpuscles of these islands are nucleated red cells containing hemoglobin that is chemically different from that of the adult (Weiss). During the second month, the *liver* takes over as the chief blood factory, and after that the *spleen* and *thymus* contribute portions. The liver declines in importance in the fifth month as the bone marrow assumes dominance in this work. In the adult, should the marrow be unable to function due to disease, the liver can again become hemopoietic, a fine illustration of the great adaptability of the body tissues.

Bone marrow is referred to as a myeloid organ, the Greek root *myel* meaning marrow. Because early anatomists thought of the spinal cord as the "marrow" of the spinal column, the term applies also to the central nervous system (myelencephalon, myelitis). This double meaning, based on error, can be confusing—poliomyelitis is an inflammation of the gray matter of the spinal cord, but osteomyelitis is inflammation of the bone marrow.

There are two kinds of bone marrow, red and yellow, the dominant tissue of each being respectively blood and fat. In the infant, all marrow is red, but as the years pass the shafts of the long bones of the arms and legs (e.g., femur, radius) become filled with fat, converting the marrow into the type called yellow, crowding out and displacing the red, hemopoietic form. Only the red form makes blood. It is found in certain of the end knobs (epiphyses) of the long bones, filling the interstices of the spongy bone, and in the vertebrae, ribs, sternum, and diploë of the skull bones—that is, the spongy bone between the upper and lower tables of compact bone. Red bone marrow collectively is one of the largest organs in the body. It makes up from two to three percent of the body weight, according to Maximow and Bloom, 3.4 to 5.9% as given by Wintrobe, or approximately the weight of the liver. Nonidez and Windle say it is more than twice the size of the liver.

The framework or stroma of red marrow is reticular tissue, through which





course many relatively large blood vessels in the form of sinusoids, and both the reticular fibers and the sinusoids are lined with *fixed macrophages*, a rather large generalized type of cell that is actively phagocytic (cell-eating) and can take up particulate matter, such as bacteria, cell fragments, or injected dye granules. Macrophage means "big eater." They may break away and float freely in the sinusoids, becoming then *free macrophages*. Scattered fat cells occur here and there, giving marrow, in microscopic view, a spongy appearance. There may be small lymph nodules.

In contrast to the stroma, the parenchyma, or essential tissue of the marrow, consists of free cells of a wide variety.

Megakaryocytes (big-nucleus-cells) compel attention because of their huge size, with a diameter up to 40 microns. The cell outline is indented and irregular, while the nucleus is divided into many irregular lobes and is frequently in the shape of a ring or horseshoe. The function of these big cells is the production of blood platelets, often incorrectly called thrombocytes (blood clot-cells; they are not cells), one of the agencies in the formation of clots. The megakaryocyte pushes a pseudopodium between two endothelial cells in a vessel wall, and then a portion of this cytoplasm projecting into the blood stream is constricted off and goes floating away as a blood platelet. The method reminds one of the way icebergs are calved, as the geologists say, from a glacier.

After identifying macrophages and megakaryocytes, the student of bone marrow next turns his attention to a bewildering array of smaller cells concerned with the manufacture of new blood cells. If he likes puzzles, this chapter in histology will intrigue him, for the different kinds are all jumbled up, like jackstraws, although groups termed "nests" of similar cells appear here and there, since several of a kind will have developed through mitoses from one. Hematologists (investigators of the blood) are divided into numerous camps by theories of origin

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of the various mature blood corpuscles. Those who believe that all of them come from a single original type of cell, the *hemocytoblast* (blood-cell-former) are exponents of the monophyletic or unitarian school; those who feel that lymphocytes have a separate origin from all the rest subscribe to the dualistic school, and some, the trialists, hold that monocytes have a still different mother cell. There are many variants of the polyphyletic theories

The hemocytoblast is a large cell as compared with mature blood corpuscles, measuring as much as 15 microns in diameter. It is rounded, ameboid (moving by pseudopodia, like an ameba) and basophilic (base-loving, referring to the type of dye with which it will react). With Wright's or similar stain this means that both nucleus and cytoplasm will be blue, the nucleus deeper and darker than the cytoplasm, which usually stains palely. The nucleus is large, round, and vesicular (appearing largely empty; from *vesicle*, sac) with the deeply staining chromatin in one or a few large masses, and a large nucleolus.

Most numerous of the many cells in red bone marrow are the *myelocytes* (marrow-cells). These are the forerunners of the *granulocytes*, those white blood corpuscles that have a visibly granular cytoplasm. Many hematologists recognize the following cell lineage: reticular cell—hemocytoblast or myeloblast—promyelocyte—myelocyte—metamyelocyte—leucocyte (also spelled leukocyte). In the promyelocyte the cytoplasm becomes less basophilic and some granules appear. They manifest different staining reactions so that three kinds of these cells can be distinguished; hence the need for the general term, granulocyte. *Eosinophils* are acidophilic, the granules staining red with eosin, as in Wright's stain; *basophils* have blue-staining granules, and *neutrophils* take both acid and basic dyes, the fine granules staining lilac. The spelling *phile* with any of these cells is also authorized. Myelocytes are smaller and have more granules. In the metamyelocytes the nucleus begins its change from more or less of a spherical shape to that of a horseshoe; when it has reached the shape of U, V or T, the cells are called *stab cells*, and unsegmented nuclei are *stab nuclei*. As the cell becomes a mature leucocyte and enters the circulating blood, the basophilia has decreased still more, the granules are more numerous, and the nucleus has begun segmentation. In the blood it is common to find them with several lobes connected by fine strands and the amount of segmentation is an indication of their age; the more lobes the older. The life span of circulating leucocytes is very difficult to determine, since they make their way out of the vessels in great numbers, entering connective tissues where they attack foreign material, or entering the digestive tract from which they are lost. Nonidez and Windle, reporting on irradiated rats, state that neutrophils stay in the blood only 23 minutes, lymphocytes 170 minutes. Weiss gives 24 hours or less, after which the corpuscles stay in the tissues only a few days. Platelet life runs from two to five days.

The basophilic series cannot be demonstrated in bone marrow by the usual technique as the granules dissolve in water and disappear. If fixed in absolute alcohol and stained with an alcoholic dye, as thionin, they may be recognized.

The red cell lineage runs as follows: Reticular cell—hemocytoblast—basophil erythroblast—polychromatophil erythroblast—normoblast—reticulocyte—erythrocyte. Among cells produced by the hemocytoblast are those with an increased basophilia of the cytoplasm, staining more deeply than the parent and on the red cell line. They are called *basophil or basophilic erythroblasts*. Then come the *polychromatophil* cells that have acquired some hemoglobin. Inasmuch as this substance stains pink, its presence in the blue-staining basophilic cytoplasm when Wright's stain is used makes the entire cell take on a lilac to grayish hue. In further cell generations the hemoglobin increases while the basophilia decreases, size diminishes and the nucleus, though shrinkage and concentration of chromatin becomes pyknotic, the adjective describing a solid, condensed, dark-staining condition. This cell is the *normoblast*, with a dense black nucleus and pink cytoplasm, and but little larger than the final red cell. It becomes mature by losing its nucleus and this is generally held to take place by extrusion, with both whole nuclei and fragments thereof appearing in the sinusoids, to be engulfed by macrophages. *Howell-Jolly bodies* are distinct basophilic granules, one or two in number, sharply outlined and either angular or rounded, that may occur in the cytoplasm of erythrocytes, and are held to represent nuclear fragments. *Cabot's rings* may be present in these cells, and seem to some investigators to be the nuclear membranes after the nuclear contents have disappeared; to others they are pathological. *Reticulocytes* are red blood corpuscles, both in marrow and in circulating blood, in which a fine reticulum can be demonstrated by using certain supravital stains, notably cresyl blue. They are immature red cells and lose the reticulum upon becoming adult corpuscles. The term is objectionable in that it leads to confusion with reticular tissue cells. Likewise normoblast, meaning the model or type cell in contrast with the abnormally large megaloblast, of pernicious anemia, is a poor term.

Some calculations about erythrocytes are of interest here. Nonidez and Windle give the total number of these cells in the body as 25×10^{12}. Their total surface area is about 2000 times that of the body, or something like 9/10 acre. Most authorities agree that their average life span is about four months. Weiss says that from 0.8 to 0.9% of them are destroyed every day, or as many as in 50 cc of blood.

There is still controversy over the way in which marrow cells get into the circulating blood. Some hold that the sinusoids are everywhere intact and that the blood system in the marrow is closed. Others believe that there are gaps in the sinusoid walls, the system being open. The granulocytes can work their way into the vessels by protruding pseudopodia and prying through between cells (diapedesis—a walking through), but the red cells have no such ability nor any motility. If they enter vessels through walls, the motivation is unknown.

A limited number of both lymphocytes and monocytes appear in bone marrow. They may be produced in this organ, although it is not their principal source, but instead the lymphoid series of organs, of which we have thus far dealt only with the spleen (Dec., 1952, issue).

Bone marrow may be studied in two kinds of preparation. An entire bone may be decalcified and sectioned, the preferred technique being Zenker fixation and phloxine-methylene blue staining, or hematoxylin-eosin-azure II. Or the fresh marrow may be smeared on a slide and handled like a blood film, staining with Wright's or Giemsa. The first kind of mount is thinner and yields sharper images, but has the disadvantage of requiring a bone decalcifier, which alters results of subsequent treatments. It is the required procedure if elements other than marrow cells are to be seen, as megakaryocytes, reticular, and adipose tissues.

In the hospital, specimens of human bone marrow for examination by the pathologist are obtained either through biopsy or aspiration. Biopsy is a regulation surgical performance. Aspiration is done by thrusting a large needle of special type into the sternum, ilium, a rib, or vertebra, under local anesthesia, and withdrawing a few drops of marrow fluid so as to make a smear slide.

POSTMOR TEMQUOTE

Conan Doyle:

"I called about that beggarman, Boone—the one who was charged with being concerned in the disappearance of Mr. Neville St. Clair, of Lee."

"Yes. He was brought up and remanded for further inquiries."

"So I heard. You have him here?"

"In the cells."

"How are their nuclei?"

"Pycnotic, Mr. Holmes, pycnotic," replied the inspector.

"Ah, Watson," said the great investigator, "I feared as much. A dash too much of bichromate in the Zenker's.! But come, perhaps we are yet in time to resolve a strand or so of chromatin here and there."

—The Man With the Twisted Lip

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